YOUR CONSTRUCTION AND OPERATING QRP SOURCEBOOK

QRP Quarterly

Volume 53 Number 3
Summer 2012

Journal of the QRP Amateur Radio Club International

- FDIM 2012 Stories from WB9NLZ and UA3LMR
- Boost Your Homebrewing IQ with WA8MCQ's Idea Exchange Column
- KE4PT and K9CHP Analyze Small Transmitting Loops for QRP
- WØUFO Shows How to Control Your Solar Panels
- QRP ARCI Contests
  - *2012 HF Grid Square Contest*
  - *2012 Spring QSO Party*
  - *2012 Hootowl Sprint*

QRP ARCI℠ is a non-profit organization dedicated to increasing worldwide enjoyment of radio operation, experimentation and the formation and promotion of QRP clubs throughout the world.

PERFECT for the BENCHTOP, BACKYARD or BACKCOUNTRY

Excitement To Go!™

FLEX-1500

Order Now!

- Industry Leading Software Defined Radio
- Full Featured 160 - 6M Coverage
- 86 db Two-Tone 3rd Order Dynamic Range Receiver
- 48 KHz Real-Time Receive Bandwidth
- Full Featured Transverter Interface
- 5W PEP Output
- Ultra-Compact Form Factor - Only 1.5 lbs.

www.flexradio.com
sales@flexradio.com 512-535-4713

FlexRadio Systems®
Software Defined Radios

© Copyright 2011 FlexRadio Systems. All Rights Reserved. FlexRadio Systems is a registered trademark and FLEX-1500 and Excitement To Go! are trademarks of FlexRadio Systems. Specifcations are subject to change without notice or obligation, and specifications are guaranteed only within the amateur radio bands. The FLEX-1500 operation requires connection to a PC running Windows XP, VISTA, or Windows 7. Personal computer and monitor required but not included.

Kanga US – Watch for Spectrum Analyzer at Dayton!

MicroR2 Receiver - $95
A 40m DC receiver. Can be modified for other bands. Extremely quiet. Boards and parts only – no case. Article in Oct 2006 QST

MicroT2 Transmitter – *Being updated*
a 40m phasing transmitter. Can be modified for other bands. VXO controlled (7.285 MHz xtal included). VXO capacitor included. 1 mw out. Board and parts only. Article in Dec. 2006 QST

6 or 2m CW source - $30
10mw CW sources for 6 or 2m. VXO Controlled (xtal included). Use small on-board trimmer or optional VXO cap for front panel control. Use as a signal source, home station TX, or rover TX.

6 or 2m Converter - $36/$40
7 MHz IF – designed to work with the microR2 or any other 40 meter receiver you may have. The front end filter is about 300 kHz wide. A very effective way to get on 6 or 2 meters!

DK9SQ Masts and Loops ($99 and $89)

UQRP TX MKII - $25
Any single band 80 – 10 meters. CW, VXO controlled (xtal included). Adjustable power output 0 – 5 watts. Parts only – No PCB on this one!

Si570 VFO - $45 ($80 with control board)
Si570 ship generates a 10 – 157 MHz signal that can be divided by 4 for in IQ oscillator for SDR and other radios. Plugs into the PICEL III daughtercard slot, or use with Control Card. In QEX July/August 2011

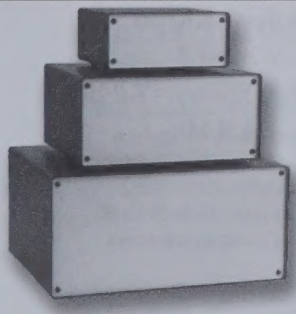
PICEL III - $65
A PIC Trainer to use with the Elmer 160 course. Program and run your software with one board. USB Interface. (I have a few PICEL II kits left with a serial interface).

Also – AADE LC Meter ($99.95 kit, $125 assembled), TiCK Keyers, CW Touch Keyers
W7ZOI Power Meter - $55

ARRL Books including the 2012 Handbook, Antenna Handbook, Joy and History of QRP by W0RSP, Tormet Bench Reference Book

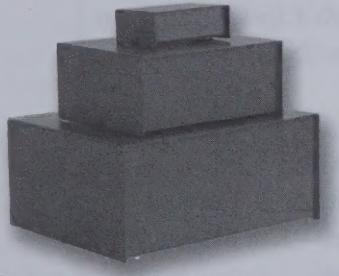
3521 Spring Lake Dr. Findlay, OH 45840 419-423-4604
www.kangaus.com

Enclosures for Projects



B-Series
Our most popular enclosure, the B-Series from Ten-Tec is equipped with an internal chassis to accommodate all your product or project needs. Built from steel & aluminum, the instrument grade B-Series is durable, dependable, long-lasting and gives your project a professional look.

T-Series
The T-Series is our basic, low-cost, all-aluminum enclosure. The T-Series & the B-Series are available in a variety of standard sizes to meet your unique specifications.



Buy Factory Direct and Save!
www.tentec.com

TEN-TEC

Ten-Tec Direct • 1185 Dolly Parton Pkwy • Sevierville, TN 37862
www.tentec.com • 800-833-7373

ESS
CRYSTALS
HF Amateur Radio Frequencies
HC-49 and Cylindrical

Expanded Spectrum Systems
www.expandedspectrumsystems.com

FAR CIRCUITS

Printed Circuit Board design and fabrication for Amateur Radio and hobby projects.

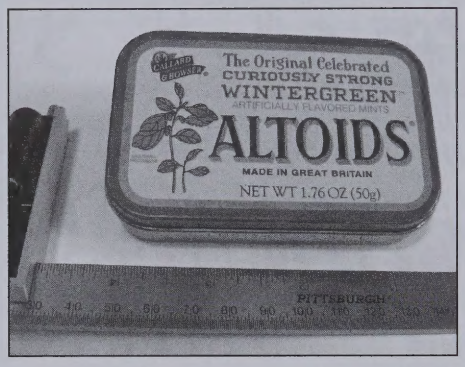
18N640 Field Ct.
Dundee, Illinois 60118
(847) 836-9148 Voice/Fax

Catalog: www.farcircuits.net
E-mail: mail@farcircuits.net

Table of Contents

QRP Quarterly

Volume 53 Number 3 – Summer 2012



page 6

page 34

page 38

Technical Articles

6 Idea Exchange—Mike Czuhajewski—WA8MCQ
Small Mint-free Non-tin Enclosures—N2CX
Chat With the Designers—N2APB, N2CX
Parts Bins—VE3CQH
Inexpensive Alternative to Flux-Off—KD1JV, W5JAY, WA8MCQ
Fix for Unstable Readings on the AADE L/C Meter—WJ2V
Improving the AADE L/C Meter Binding Posts—WA8MCQ
Toroid Clip from a Clothespin—WA6DZS
Use Bottle Top to Seal a Bag—WB6NST
Extra-Low-Power Pilot Light—KN8KAZ
Telling Type 43 and 61 Toroids Apart—WA8MCQ
20 Buddistick Vertical Antenna Tests—Michel Boissonnault—VE2TH
22 How Efficient is Your QRP Small Loop Antenna?—Amir Findling—K9CHP, and Kai Siwiak—KE4PT
30 PC Board Construction 101: Part 2—Chuck Adams—K7QO
31 QRP-TECH Project Number 001—Chuck Adams—K7QO
38 Three Wheels and Five Watts—Rem O'Donnelley—K6BBQ
46 Dual Gate MOSFET Odyssey: Part 3—Pete Juliano—N6QW
48 Designing a Solar Power System for QRP Operation—Mert Nellis—WØUFO
50 Antennas 101: Elevated Verticals—Gary Breed—K9AY

The Joy of QRP

16 QRP Clubhouse—Tim Stabler—WB9NLZ
23 VHF QRP: How to Find VHF Openings—James R. Duffey—KK6MC
26 Four Days in May (FDIM) Report—Timothy Stabler—WB9NLZ
33 Ten Steps for Successful QRP Portable Operation—Brian Murrey—KB9BVN
34 New Discovery of America for FDIM—Stan Sindeev—UA3LMR
40 QRP and Me—Martin Huyett—KØBXB
52 QRP Contests—Jim Rodenkirch—K9JWV
2012 HF Grid Square Contest
2012 QRP ARCI Spring QSO Party
2012 Hootowl Sprint

The World of QRP ARCI

3 Editorial—Tim Stabler—WB9NLZ
4 From the President—Ken Evans—W4DU
5 QRP ARCI Awards
56 New or Renewal Membership Application
56 QRP ARCI Staff and Directors

ARCI[SM] and QRP ARCI[SM] are service marks of QRP Amateur Radio Club International

QRP QUARTERLY EDITORIAL STAFF

Editor
Tim Stabler—WB9NLZ
2153 Walker Dr.
Valparaiso, IN 46385
wb9nlz@yahoo.com

Associate Editor & Idea Exchange
Mike Czuhajewski—WA8MCQ
7945 Citadel Dr.
Severn, MD 21144-1566
wa8mcq@verizon.net

Associate Editor
John King—W5IDA
9936 Whitworth Way
Ellicott City, MD 21042
w5ida@arrl.net

Associate Editor
Dennis Markell—N1IMW
47 Old Farm Rd.
Bedford, NH 03110
dennis_m_markell@uhc.com

Associate Editor—Contests
Jim Rodenkirch—K9JWV
762 East. St. James Ln.
St. George, UT 84790
contest@qrparci.org

Production & Advertising
Gary Breed—K9AY, and staff
AY Technologies LLC
PO Box 43
Mount Horeb, WI 53572
gary@aytechnologies.com

REGULAR COLUMNISTS

QRP Clubhouse
Tim Stabler—WB9NLZ
wb9nlz@yahoo.com

QRP ARCI Awards
Paul Stroud—AA4XX
awards@qrparci.org

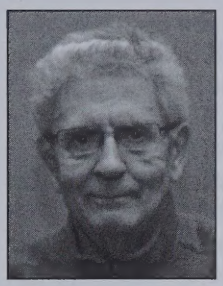
VHF QRP
James Duffey—KK6MC/5
JamesDuffey@comcast.net

QRP World News
Oleg Borodin—RV3GM
rv3gm@mail.ru

Antennas 101
Gary Breed—K9AY
k9ay@k9ay.com

Editorial

Tim Stabler—WB9NLZ wb9nlz@yahoo.com



Here we are with the summer ahead and many things to get done before the season is over. I must start off by apologizing to someone who wrote asking about a certain type of column he was interested in seeing in this publication. I looked at his email and then went to others that had come in. When I went back to answer the original email, it was gone!! It was even gone from the trash! I have no idea how that happened and I am embarrassed by it happening, but it did. Again, I am extremely sorry that it happened. Please write me again with your question and I promise to answer right away.

Did you attend FDIM and/or the Dayton Hamvention? If you did, you were one of the 24,483 attendees, according to official attendance results. Although I have lived in Indiana since 1973, this was not only my first year at FDIM but also my first year at Dayton. I know, it is only about a 5 hour drive from my home there but when I first came to Indiana, the final week of the Spring semester was when Dayton was held. When it got moved into May, I was teaching Summer School every night. So I got used to not even thinking about it. That changed big time this year. I got there and had a wonderful time at both venues. I got to meet people who I have had contact with via email as well as many others including Stan Sindeev, UA3LMR, from Russia and Pietro Bengali, I2RTF, from Italy. I took some pictures and have written up FDIM for you. I also have a FDIM write-up from Stan, UA3LMR, which is included. If you want to attend next year, the hotel (Holiday Inn, Fairborn, OH) is now accepting reservations.

I had several things sent to me from about the time the Spring issue went to the publisher. That was good as it gave us time to look at anything sent in and time for the writer to do any changes we thought should be made. If you have a project in mind, write it up and send it in. From my write-up on FDIM, you will see that Fred of Far Circuits told me he would do any board you might need for free.

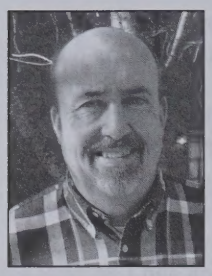
I urge everyone to read the FDIM article by Stan Sindeev, UA3LMR, who came to FDIM from Russia. He tells you what a first trip to the States can be like for someone like him. I guess we take a lot for granted until we find out what it is like in the real world. He did have a good time and he was a very interesting fellow to talk with. He did include many pictures of his trip in his article.

72/73 de WB9NLZ

From the President

Ken Evans—W4DU

president@qrparci.org



There are a number of things that have occurred since the Spring issue of QRP Quarterly was published. So here is an update, in no particular order:

FDIM 2012 Notes

I am still recovering from FDIM!! A great time was had by all and a number of you have requested some statistics about the event. It was a record breaker in attendance. We had a total of 350 people register for the Seminar and or Banquet. Of that number, 280 people attended the Thursday seminar and 262 attended the banquet. We used all 174 hotel rooms at the Holiday Inn, and overflowed 10 rooms to the Homewood Suites next door.

We are approaching capacity under our current layout for the seminar, banquet and hotel rooms. However, we are working with the hotel staff to rearrange the seminar and banquet layout to accommodate more people if needed. Also, we will have more hotel rooms available next year, although some still may require overflow to a nearby facility. We are doing our best to insure there is room for everyone that wants to attend.

FDIM 2013 Hotel Rooms

Many of you have asked that hotel room bookings for FDIM be made available earlier in the year. We have discussed this with the staff at Holiday Inn Fairborn and have decided to start the reservation process for FDIM 2013 immediately. The dates for FDIM are Thursday, May 16, 2013 through Sunday, May 19, 2013. The rate for 2013 will be $111.00 per night plus 12.5% tax and includes a free breakfast buffet.

The process will be different from previous years in that the club will not be taking the reservations. The Holiday Inn Fairborn will be the contact and take all reservations. You must call the Holiday Inn Fairborn at 937-431-4613 to make your reservations. It will be staffed Monday thru Friday from 8:00 AM to 5:00 PM. If you call after hours, leave a voice mail and your call will be returned. You must tell them you are with "FDIM" to receive the $111.00 per night rate. Do not call the Holiday Inn toll free number.

Once again, these rooms are only available by directly contacting the Holiday Inn Fairborn at +1 937-431-4613. We hope this makes the FDIM planning process easier for all of you.

Board of Director and Officer Elections

The terms of three members of the QRP ARCI Board of Directors will expire on June 30, 2012. We issued a call for nominations for these positions in the winter 2012 issue of the *QQ*. Four candidates stepped forward. They are:

- Craig Behrens, NM4T
- Steve Fletcher, G4GXL (incumbent)
- Ed Hare, W1RFI (incumbent)
- Bill Kelsey, N8ET (incumbent)

We published their names and bio info in the Spring 2012 *QQ* and asked for each active member to vote for three of the four candidates by June 1, 2012.

The votes are in and the three incumbents have been reelected to a four year term starting on July 1, 2012. Congratulations to Steve Fletcher, G4GXL, Ed Hare, W1RFI and Bill Kelsey, N8ET on reelection. I also thank Craig Behrens, NM4T for his willingness to stand for election.

The term for President (Ken Evans, W4DU) and Vice-President (Kathy Bromley, WQ5T) expire on July 1, 2012. The Board of Directors met in Dayton on May 17, 2012 and took the following action per the by-laws:

Ken Evans, W4DU was elected President of QRP-ARCI for another 3-year term. Kathy, WQ5T, voiced she would not seek re-election. The board then elected Steve Fletcher, G4GXL, as Vice President of QRP-ARCI for the next 3-year term. Steve will be holding two elected offices as both a Board Member and as Vice-President. This is permitted per the by-laws. However, he will be limited to one vote on items requiring a vote.

That completes the update on your QRP club's activities. I hope to see some of you on the air in the upcoming contests or perhaps just a casual QSO.

—72, Ken Evans, W4DU
President, QRP ARCI
president@qrparci.org

●●

Is your QRP ARCI membership (and *QRP Quarterly* subscription) current?

You can check your expiration date quickly at the club website:

www.qrparci.org

Just click on "Member Lookup" in the navigation panel on the left side of the home page — then enter your own callsign or QRP ARCI member number.

QRP ARCI Awards

Paul Stroud—AA4XX awards@qrparci.org

Congratulations to Jim, W4QO, who received awards for quite a few categories this past quarter:

- 1000 MPW
- Worked All ARCI – 400 ARCI members (first Gold Level issued)
- QRP DX – 221 countries
- 5 Band QRP DX – 40,30,20,15,10M
- County Hunter – 500 counties
- Grid Square – 600 grids
- QRP All States – all 20M
- QRP All States – all K6JSS Jubilee Stations

The 1000 Miles per Watt Award

QRP ARCI's KPMW Award continues to be quite popular, with these QRPers being the latest ones to earn it:

- Roy, KV8KV, worked VY2SS during ARRL Sweepstakes CW while running 250 mW on 15M, for 4546 Miles per Watt.
- Rem, K6BBQ/Tricycle Mobile, worked JH6WHN on 10M SSB for a special "Human Powered Endorsement" for 1125 MPW. You can find a YouTube link to Rem's remarkable achievements on his QRZ.com page.
- Ignacio, EA2BD, worked N4EX while running 2.5 W from the summit of Erreniega Mountain in Navarra, Spain as a SOTA station. This was a 2 x QRP contact on 20M CW, earning Ignacio an award for 1598 MPW.
- Bob, WB3T, demonstrated how the MPW figure adds up by working W5VYN on 15M CW while running 100 mW, netting him an awesome 12,714 MPW.

Grid Square Award

Larry, K5ZRK, continues to build his QRP grid totals on two bands. Larry has been issued one award for working 300 grids on 5 MHz All SSB, and another award for working 300 grids on 10.1 MHz All CW.

QRP All Continents

Three stations have earned the QRP All Continents Award within the past few months, each running a different mode-Chuck, KA8HDE (CW), Galen, AGØA (JT-65), and "Arizona" Jack, K7KGB (SSB).

The QRP Worked All States Award is also popular. Please tune in next issue for a run down on your fellow ARCI members who are working on this award.

To date, there have been no submissions for the 5 Band QRP WAS Award. Perhaps some of you may take up that worthy challenge while we have some sunspots to help us out on the higher bands.

Just a note about the 1000 Mile per Watt Award: QSL card submissions are not required for this award. QRP ARCI members who are currently subscribed to the monthly *QQ* journal may send the KMPW application to me via email at: awards@qrparci.org or via snail mail at the address on the application.

Get busy making QRP QSOs! Then I'll look forward to receiving your next award application.

—72, Paul AA4XX

●●

Find awards information on the QRP ARCI website: www.qrparci.org

We are pleased to announce our 3rd ***Two Days in Huntsville (TDiH)*** QRP extravaganza August 18-19, 2012.

Seven QRP Forums will be presented as follows:

Saturday, 8/18/12:

- 11:00AM *QRP ARCI's Introduction to QRP,* **Rich Arland—K7SZ**
- 1:00PM *QRP Day Tripping—Portable QRP Operations with Style,* **Greg Lane—N4KGL**
- 2:00PM *New ARGO-VI QRP Transceiver and other new Products,* **Jim Wharton—NO4A/TenTec Vice President**
- 3:00PM *All Things CW,* **Dick Bentley—K2UFT**

Sunday, 8/19/12:

- 11:00AM *Adventures in QRP Contesting,* **John Laney—K4BAI**
- 12:00PM *QRP DXing—Outperforming the Big Guns with 5-Watts,* **Craig Behrens—NM4T**
- 1:00PM *DX from Antennas in a Mulberry Tree (in Iraq),* **Jerry Brown—N4EO/YI9EO**

After enjoying Saturday's **Huntsville Hamfest activities in the Von Braun Convention Center**, you are cordially invited to make the short, 7.5 mile—1,900 feet of it up, trip to the **Monte Sano State Park Campgrounds** for our **Traditional Southern BBQ** and to participate in the main event, another wild and crazy QRP contest. (Please note that a number of QRPers will already be camping there.)

The nature and details for our **Novel QRP Contest** (as well as the identity of our **celebrity judge**) are not revealed until the BBQ is well underway and we've regained some semblance of control.

If you're interested in having all the QRP fun mere mortals can handle and going to events where (almost) everyone wins a fine, QRP-centric **Door Prize**.

Still not convinced? Cheese Heads, Flying Pigs, NoGAnauts and a bunch of really notorious QRPers who have attended past TDiH's can tell you—**This is where you need to be that Saturday night!**

(**NOTE:** Articles in the *Fall 2011 QRP Quarterly* & the *November CQ Magazines* last year's TDiH.)

Please stay tuned for TDiH event updates and take a look at the Huntsville Hamfest website for a plethora of useful information: **www.hamfest.org/**

Our *TDiH Event Brochure* and additional details will be available at QRP ARCI's Booth at the Huntsville Hamfest.

So gang, start forming carpools and making your travel plans to join us.

See you there!

Craig Behrens—NM4T
Craigb44@msn.com

Idea Exchange

Technical Tidbits for the QRPer

Mike Czuhajewsi—WA8MCQ wa8mcq@verizon.net

In this edition of the Idea Exchange:

Small Mint-free Non-tin Enclosures—N2CX
Chat With the Designers—N2APB, N2CX
Parts Bins—VE3CQH
Inexpensive Alternative to Flux-Off—KD1JV, W5JAY, WA8MCQ
Fix for Unstable Readings on the AADE L/C Meter—WJ2V
Improving the AADE L/C Meter Binding Posts—WA8MCQ
Toroid Clip from a Clothespin—WA6DZS
Use Bottle Top to Seal a Bag—WB6NST
Extra-Low-Power Pilot Light—KN8KAZ
Telling Type 43 and 61 Toroids Apart—WA8MCQ

Small Mint-free Non-tin Enclosures

Joe Everhart, N2CX, presents the latest installment in the endless series of Technical Quickies he promised me years ago, Quickie number 82.

Like many homebrewers I've built lots of stuff in Altoids® tins (Figure 1). They're cheap, convenient and have a geeky attractiveness. But they have some shortcomings, too. The metal is thin and awkward to properly machine, they are kinda flimsy and they are often too small to contain any but very simple projects. So the time came to expand my homebrew case options by fabricating some small but customizable enclosures. In keeping with the DIY theme and my own frugal nature I decided to build some mint-free non-tin enclosures using copper clad printed circuit board material.

Now I've been building small cases from copper clad board for a number of years with varying degrees of success. I've built rectangular boxes, so-called "shadow" boxes with top covers extending over the front panel (to hide construction imperfections) and several (hopefully) RF-tight boxes with internal covered compartments to provide interstage shielding. While certainly functional, none of these have been paragons of homebrew beauty. I even wrote up some of the efforts for QRP journals (Ref 1, 2). But it always seemed that there should be better ways of building them than I'd done.

I was re-inspired by some information posted online by Chuck Adams, K7QO. He put together a couple of web pages with lots of photos and a very good detailed step by step procedure (Ref. 3, 4). The fixturing and techniques he presented made my end results much closer to perfection. Gotta admit that one of the biggest things I'd done wrong was to run a solder bead along each mating surface. Chuck uses short widely spaced beads along the seams. This allows for much easier building as well as giving more freedom to correct the inevitable "whoopsies" that occur.

Then yet another look at the topic revealed itself in a web search (Ref. 5). Ken, WA4MNT, took a similar approach to K7QO's and in addition solved my final dilemma. His instructions pointed out that when the solder beads on the seams solidify they very slightly draw the seam inward, making the angle several degrees more acute than 90 degrees. The cure is to put a spacer of sorts (he recommends small gauge wire) between the vertical piece being joined and the alignment fixture and carefully reheating the beads until the desired right angle is achieved. His instructions and pictures do a great job of explaining the whys and hows of getting the pieces (he said punfully) back to normal.

The first enclosure made using these new improved methods was slightly larger than the old mint tin. The one in Figure 1 is about 2-1/4" x 3-1/8" x 3/4" internally. To give slightly more interior room without drastically affecting the form factor I chose interior dimensions of 2-3/8" x 3-3/8" x 7/8". Figure 2 shows the individual dimensioned pieces needed to make the box and Figure 3 shows a sketch of how the pieces fit together. In my box I chose to have the top piece soldered in place and the bottom removable—more about that later.

Following the methods described in the web references, assembly was done in the following order. Note that front and back pieces B and D are the full length of the box so their ends will align with piece A. Side pieces C and E are smaller so they will fit between the ends of B and D to

Figure 1—The ubiquitous Altoids tin.

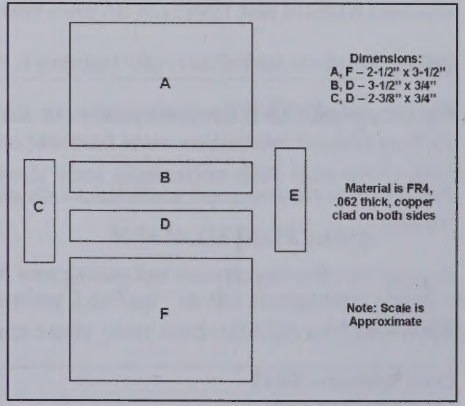


Figure 2—Pieces used to make the box.

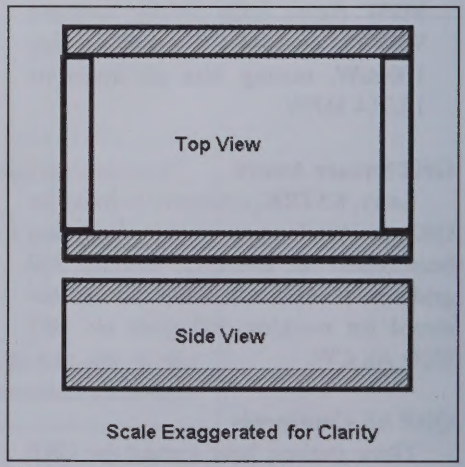


Figure 3—Orientation of box pieces

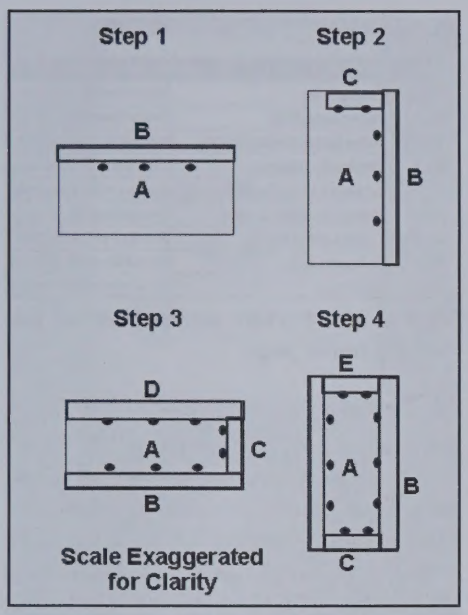


Figure 4—Step by step box assembly

form flush ends to the finished box. Figure 4 shows the steps. By the way, the black "blobs" are the solder beads that hold the pieces together.

1. Set one of the top/bottom pieces—call it A—on your bench next to the alignment angle. Solder the front piece B along the long dimension of A. Reheat solder beads and reposition to get a good 90 degree angle between them.

2. Align an end piece C to the short dimension of the piece A and add solder beads. Do the necessary realignment to assure that it has proper 90 degree orientation.

3. Install back piece D on the long side of piece A and assure proper alignment.

4. Install second end piece E on the open end of piece A and perform alignment.

5. Carefully solder a bead on each of the vertical seams to secure the front and back pieces to the end pieces. Carefully remelt the vertical beads as needed to assure flush box ends.

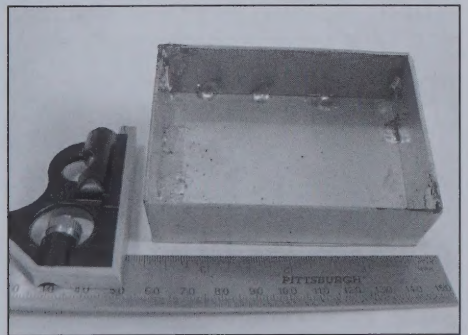


Figure 5—The assembled box.

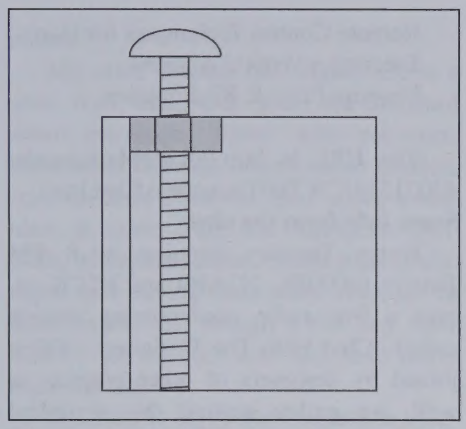


Figure 6—Stainless steel bolt holds brass nut in place for soldering

When the box is flipped over it should look like Figure 5. Piece A which was at the bottom during assembly is now the top. The box bottom will be secured using nuts and bolts. Brass nuts can be easily soldered into the box corners flush with the open edge. To do this you can hold the brass nut in place flush with the top edge of the open box with a stainless steel bolt that is longer than the inside box height. Screw the nut onto the bolt placing the far end of the bolt on the bottom of the box and hold the head end of the bolt while soldering the nut in the corner as in Figure 6. Wrap the bolt head with duct tape to keep from burning your fingers. Using stainless steel is important so that you won't solder the bolt onto the nut! Figure 7 is a box with two nuts soldered in diagonal corners.

Figure 8 shows a completed box with nuts only in diagonal corners and a cover partially rotated off the case. Note that the cover is secured in only two places. The left hand corner of the cover has a regular round hole but you can see that the right hand hole is slotted. When both bolts are tightened the box cover is secured.

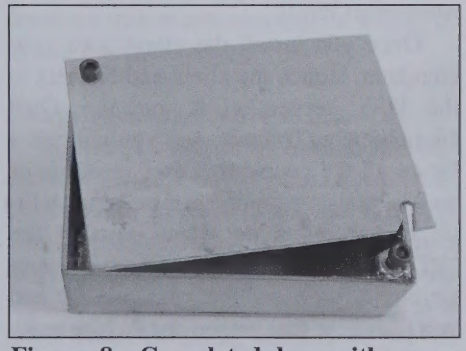


Figure 8—Completed box with cover partially rotated off.

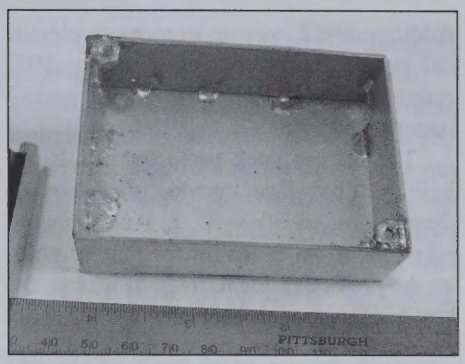


Figure 7—The box with 2 nuts in diagonal corners.

However if you loosen both bolts you can swivel the cover to one side without removing either one. I wish I had been clever enough to have thought of this myself but have to admit I stole the idea from Doug Hauff, KI6RIE, who uses it on the AA1—Altoids Alternative enclosure, a deluxe milled-out Altoids tin replacement (Ref. 6). Doug uses special screws with an oversized knurled head to hold the cover in place. The photo of my box shows widely available cap head screws that work nearly as well.

Naturally, if you want to, you can solder nuts in all four corners and use a cover with four round holes.

The next enclosure underway in my workshop is one intended to protect a portable power source used for my portable QRP operations, a holder for 8 AA cells, shown in Figure 9. These plastic holders often suffer damage (I'm a klutz) from being thrown into a backpack or storage box and I'm always afraid of a catastrophic short circuit from loose metal pieces or wires during transit. A nice box sized slightly larger than the holder can be lined with protective foam and a connector on the box will lessen the possibility of inadvertent fiery misadventures.

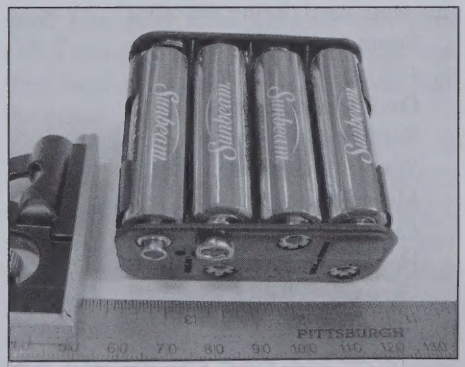


Figure 9—A holder for 8 AA cells.

Additionally, I provide even more electrical protection by adding a cheap PTC resettable fuse in line as many commercial battery packs do.

The battery pack protector box is not built yet but I've decided that internal dimensions of 3" x 3" x 1-1/4" should allow plenty of room for the battery holder, the protective foam, internal wiring, the box-mounted connector and a PTC fuse. Look for it next time I'm using my MTR in the woods.

References:

1. Joe's Quickie #33, N2CX, "PC Board Boxes," *QRP Quarterly* April 2000, in the WA8MCQ Idea Exchange column.

2. Test Topics and More, Column No. 6, N2CX, *QRP Quarterly* January 2001.

3. K7QO pc board enclosure instructions: http://k7qo.net/pcb_construction.html

4. Yet another similar but different page by K7QO on basically the same topic: http://k7qo.net/enclosure_tutorial.html

5. Ken LoCasale WA4MNT PCB chassis methods: http://qrpbuilder.com/downloads/ pcb_chassis_a.pdf

6. American Morse Equipment AA1 Enclosure: http://americanmorse.com/aa1.htm

—DE N2CX

Chat With the Designers

That's the name of an interesting weekly, real-time online audio gathering started in November 2011 by George Heron, N2APB and Joe Everhart, N2CX. Using a system called Teamspeak, participants log onto a server and listen to George and Joe discuss the technical topic of the week, and can add their own comments or questions. The sessions are stored online and you can listen to any of the old ones as podcasts. You can also view the figures and graphics that were used during the talks.

Some past topics include:

Oscilloscope Basics
Soldering 101
Simple & Accurate Power Measurement
Circuit Simulation
Homebrew Battery Chargers
Grounding 101
Low Pass Filter Design mini-tutorial (3 sessions)
Intro to the Digital Modes
Remote Control Techniques for Hams
Erecting a Vertical Antenna
Favorite Parts & Kit Suppliers

The URL is http://dl.dropbox.com/u/43021514/CWTD/TeamspeakChat.html

Some info from the site:

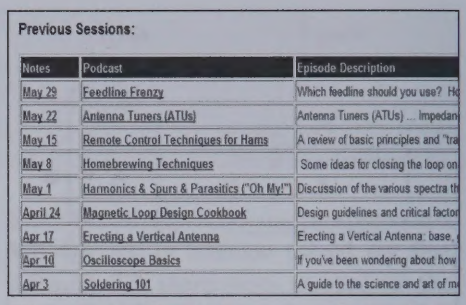
Every Tuesday evening at 8 PM Eastern (0000Z), N2APB and N2CX co-host a live audio conferencing session called "Chat With The Designers." Often joined by designers of other projects as well, we gather around this technical watering hole to discuss various topics that are of interest to us all. Whether you seek information about your latest project on the bench or just wish to listen in on the various designers discussing some new chip or product/kit solution they are currently working on, this is the place to be.

For a little more than an hour, or as long as the discussion is lively, N2APB and N2CX run the session in "net control"-like fashion, guiding the discussion and passing the mic in an orderly way among all participants. Augmented by a very useful "text chat window" at the bottom of the screen, everyone is able to post text comments, links and other information when the urge strikes. We record the audio from each session, as well as save the text chat window great reference later on.

We're using Teamspeak 3 (TS3), an Internet-based multi-client audio conferencing system. TS3 is available to run on just about every operating system ... Windows, Mac, Linux, and even the mobile platforms like Android and iOS 5 (Apple)! It's free, presents no spam or "friend" sign-ups, and is easily downloadable and configurable. See our Teamspeak Instructions page for downloading and installing TS3.

[The URL for that is http://dl.dropbox.com/u/43021514/CWTD/TeamspeakInstructions.html]

Once you install the client onto your computer, launch the client and connect to the TS3 server, click on the QRP Homebrewing channel, and you will see a list of all the people that are signed in, as well as your own name and callsign. A little button lights up when pressing the "PTT switch" (a key you set up on your keyboard for when you wish to talk) and you then hear that person speak. You reply by doing the same when you see that nobody else's PTT light is on. Pretty easy and really enjoyable to use.



Previous Sessions:

Notes	Podcast	Episode Description
May 29	Feedline Frenzy	Which feedline should you use? Ho
May 22	Antenna Tuners (ATUs)	Antenna Tuners (ATUs) ... Impedan
May 15	Remote Control Techniques for Hams	A review of basic principles and "tra
May 8	Homebrewing Techniques	Some ideas for closing the loop on
May 1	Harmonics & Spurs & Parasitics ("Oh My!")	Discussion of the various spectra th
April 24	Magnetic Loop Design Cookbook	Design guidelines and critical factor
Apr 17	Erecting a Vertical Antenna	Erecting a Vertical Antenna: base,
Apr 10	Oscilloscope Basics	If you've been wondering about how
Apr 3	Soldering 101	A guide to the science and art of m

Figure 10—Partial screen shot of the CWTD home page.

Figure 10 is a partial screen shot of the web page. Under Previous Sessions, the first column is Notes. Click on any item to view the slide show that was used during that session. To listen to the audio file, click on the session title in the Podcast column. The Episode Description column (partially cut off here) is self explanatory.

Parts Bins

Homebrewers who have been around for a while usually have a pretty good parts stash, and hopefully a good way of storing and arranging it. Although there are plenty of fancy and expensive storage bin systems available, those just starting out (and us old cheapskates as well!) might prefer a no-cost solution, at least in the beginning.

Charles Hooker, VE3CQH, sent this in via e-mail:

I'm always interested in the Idea Exchange, but felt unable to contribute until I read the suggestion about pill-bottle parts storage. Here's another idea.

Years ago, when I was with the Canadian Black Watch 2nd Battalion, I came across a free source of Robert Burns cigarillos boxes. Needing parts storage for my shack, I collected a bunch and then discovered that my other hobby—photography—provided metal 35 mm film cans that just fit in the boxes.

More recently I have been perfecting

Figure 11—Sturdy cardboard boxes used for parts storage.

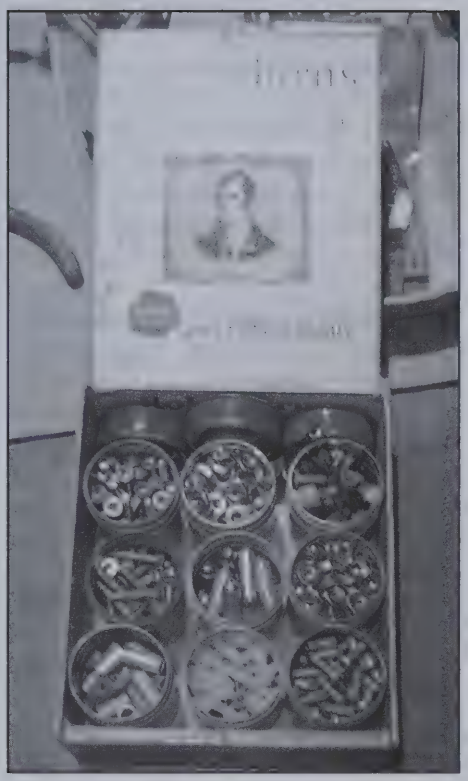


Figure 12—Film canisters hold different types of parts.

the Ultimate Ham Shack in my cellar and created a number of shelves. Figure 11 reveals my R Burns box collection, with parts descriptions in pencil (for ease of amendments) on the fronts.

The next photo, Figure 12, shows the inside of my # 6 hardware parts bin (bottom, left, above). Each box holds nine film cans, and the covers of three cans at the rear prevent unnecessary movement. The lid prevents any spillage when moving boxes around. (Each box is 5 x 4-1/4 x 2 inches.)

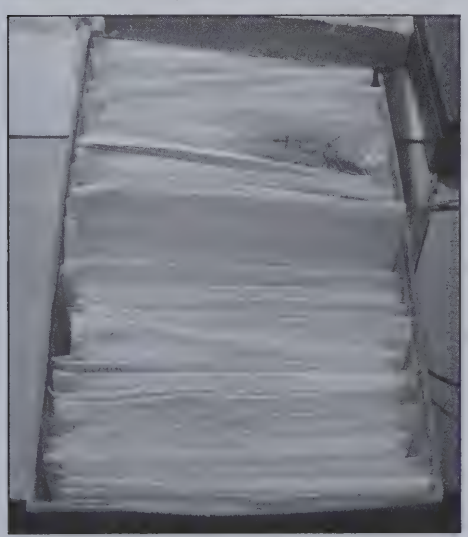


Figure 13—Envelopes in a shoe box.

My other storage bin, Figure 13, is a shoe box, especially good for standard small envelopes filled with resistors, capacitors, toroids, transistors, chokes, crystals, kits, whatever. This is not a new idea; it came from the American QRP Club, whose magazine I much miss. I also regret not buying their offer of a set of fixed capacitors, though I did buy their resistor set (in this box) and have never regretted that.

Needless to say, parts continue to accumulate and spill across my work bench, but the critical, long-term storage is properly organized.

Hope this is useful for someone.

—de VE3CQH

WA8MCQ comments: While it probably won't be possible to exactly duplicate the techniques, it should get people to thinking about things and looking at common items differently and get the juices flowing.

With the decrease in smoking, boxes of this sort might be harder to come by although specialty stores probably still toss out a lot of them, and there are certainly lots of other types of boxes floating around. As for the film canisters, all I've ever seen in my adult life were the plastic ones. They did away with the metal cans decades ago. (As always, the bean counters win. Save a few cents per roll and multiply that by millions of rolls sold and it adds up.) Of course, now that digital photography has pretty much killed off film there aren't very many plastic film cans left, either.

But there are still plenty of alternatives. For instance, I am on several long term medications, which are always supplied 90 days worth at a time. That means bigger plastic pill bottles, and lots of them! And if you're not old yet, you probably know someone who is and who will be willing to save the bottles for you.

Inexpensive Alternative to Flux-Off

Although some things such as military and aerospace products require that all flux be removed, whether or not that is necessary for everything else is always a matter of debate. Whenever the subject comes up on any online forum it is debated for a good while, including whether or not the so-called "no clean flux" needs to be cleaned off. And many people prefer to remove all flux for cosmetic reasons, if nothing else

Some of the commonly used solvents include alcohol and acetone (although you have to be careful that the latter does not attack anything). At work we use both alcohol and Axarel 2200. The latter does not leave the white residue that alcohol sometimes does.

However, it is not cheap. Although you can get it in small containers for home use, at work we get it in 5 gallon pails and depending on the vendor those are anywhere from just under $300 to well over $400. (A 5 gallon pail of high purity technical grade isopropyl alcohol costs about $100. You don't want to know what the ultra high purity reagent grade goes for.)

There is a popular flux remover called Flux-Off, which comes in a variety of types. A 10 oz spray can costs around $14 to $17 depending on type. In a discussion of removing flux on one of the online QRP forums, Steve Weber, KD1JV threw out the name of a less expensive alternative—QD Electronic Cleaner found in the automotive department of Wal-Mart does a good job and does not leave a residue like alcohol often does. However, it is best used outside due to the nasty fumes and is highly flammable.

—KD1JV

Jay Bromley, W5JAY, responded—

I had to look at what I have on the shelf in the garage and it is indeed QD Electronic Cleaner. As you said, it can be found in Wal-Mart and most automotive sections. I buy mine at the local hardware store. On the back of the can it even says that it will remove flux. At first I was a little leery about using it since it says "harmless to most plastics and paper tapes." After trying it on some electrolytic capacitors in old gear I didn't fear using it on my good kits. It is much cheaper than Flux Off. I compared ingredients years ago and they were almost the same. QD was half the price!

I still use alcohol while building and try to get it as good as I can. I try to use QD on top of the board to remove anything I may have missed. It is great for getting into places you can't reach with Q-swaps or paper towels soaked with alcohol. I try to use QD for finish work and it will last a long time that way. Sure does a nice job and is quick if you use it only for flux

removal instead of alcohol first, but I tend to use up a can fairly fast that way.

—W5JAY

WA8MCQ comments: I bought a can of this a few months ago, for use as a contact cleaner. The 11 ounce can was about $8 at Advance Auto Parts, a national chain. Look for a red can and the CRC logo. You do want to be sure that you have good ventilation when you use it, and be sure to read all of the notes on the can. (For those who are MSDS fluent, both the NFPA and HMIS ratings are 2-3-0.) The can also mentions that it may remove lubrication on moving parts and that it might be necessary to relubricate.

I noticed that the Home Depot web site has a CRC product, QD Contact Cleaner. It has a blue can, and the manufacturer number is different. I have no experience with that product and don't know if it will remove flux but probably not. The Applications section of the CRC web page about the QD electronic cleaner specifically mentions flux removal, which is conspicuously absent from the Applications for their QD contact cleaner.

Back to the Axarel 2200, it's not terribly expensive in small cans for home use. I found a couple of well known online sources (HMC Electronics and All-Spec Industries) that have it for about $15 for a 10 oz can, in the same range as Flux-Off. It does dry noticeably slower than isopropyl alcohol, which takes some getting used to, but as I said it does not leave the white residue that alcohol does sometimes.

Fix for Unstable Readings on the AADE L/C Meter

The L/C IIB from AADE is an accurate and very handy hand held instrument which has been popular among homebrewers for many years. In a comparison of several different LC meters recently on the QRPTECH forum on Yahoo.com, Chuck Adams, K7QO, mentioned that his AADE had some instability in the readings after zeroing it, especially when he had his homemade test fixture plugged onto it.

Preston Douglas, WJ2V, mentioned that he had the same problem and came up with a simple fix which increases the value of a bypass capacitor. Several people later reported that their units had the same issue and that the fix cleared it up.

Chuck said, "There is one feature of this meter that I absolutely do not like one bit. I don't know why it does it and I'd like to hear from others, if your meter does or does not do this. I turn it on and let it self-calibrate. Switch C on and the display shows some non-zero value. Push and hold the calibrate button. Upon release the value will flutter between and around zero, but it just doesn't lock the value into the display."

Preston replied—

"I have been having problems with my somewhat elderly AADE L/C meter. In the last couple of years it was persnickety with even slightly less than fresh batteries when measuring capacitors, and unstable to the point of useless for measuring inductors, regardless of battery. I went so far as to email the owner of AADE and he suggested contact cleaner on the switches. So, hearing that others are seeing similar issues, I decided to see if a really fresh battery would restore function. No. Nor did reheating the solder joints, reseating the PIC controller chip or the LM311 comparator. Nor did exercising the switches, just in case AADE was right."

While the meter was open, Preston noticed that the readout stabilized when he held the board in a certain place, which was at the left side. That was near the LM311, which is used as an oscillator, and C5. The latter is a 0.1 uF bypass capacitor on the power trace to the LM311. He checked the C5 solder connections, and then he tacked another 0.1 uF capacitor across it, on the underside. He said the zero reading instantly stabilized to 3 decimal places. There was nothing wrong with the existing capacitor; it just needed a little extra bypassing in his unit.

He wondered if the cure was unique to his AADE or if he had come across something of use to others, and asked for comments. Several people reported that they had the instability issue, and that adding another 0.1 uF capacitor across C5 fixed it for them. (Some removed the original capacitor and replaced it with 0.22 uF.) Some reported that they did not have the problem, and the one I bought in 2003 doesn't do it, either, so not everyone will need to do the fix.

Later, in private mail, Preston said:

"The funny thing is that my AADE worked just fine for years, until it just didn't, and it even continued to work OK for capacitors, just not for inductors. The fix seemed to cure the problem completely, and even stabilized some small jitter in the least significant digit that it always had, but which I ignored, since I was happy with 'good enough.' Now, when I zero it once or twice, it hovers within one significant digit of zero, even without much of a warm-up."

In May, a couple of months after Preston publicized his fix, I had the company order an assembled AADE meter for my bench at work. (We have all sorts of fancy HP LCR analyzers and network analyzers that can measure capacitance, but the AADE is far faster and more convenient to use for noncritical applications.) I opened it up to take a look inside and noted that the value of C5 is now 0.22 uF instead of 0.1 uF as it had been for years. (The online manual still indicates 0.1 uF, although they had been using film capacitors for that position instead of a monolithic ceramic for some time.) With luck, future owners will never see this issue.

Before you take your meter apart to do

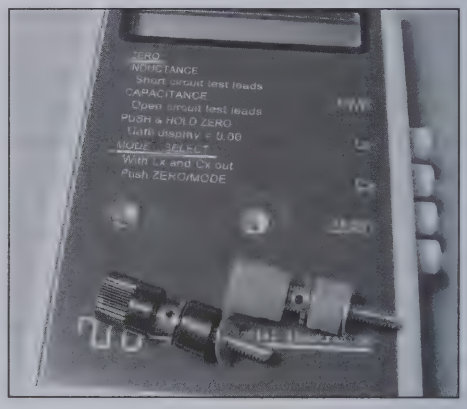


Figure 14—To take the L/C meter apart, first remove both binding posts.

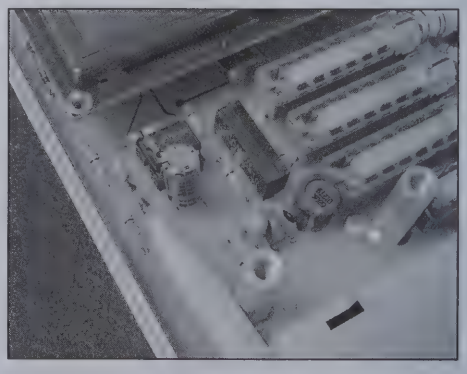


Figure 15—The pencil is pointing to C5, 0.1 uF. Replace it with a 0.22 uF monolithic ceramic capacitor, or tack another 0.1 across it.

the mod if it needs it, take a look at Figure 14 first. If it's been a long time since you've built yours or opened it up, you've probably forgotten that both binding posts have to be removed since they help the 4 screws hold it together. Just unscrew them from the threaded spacers on the PCB. In Figure 15, the pencil is pointing to C5.

Ref: AADE, Almost All Digital Electronics, operated by Neil Heckt; URL www.aade.com.

Improving the AADE L/C Meter Binding Posts

As supplied, both with the one I bought in 2003 and the one they just bought for me at work came with regular binding posts, not 5-way binding posts. There's nothing inherently wrong with the non-5-way parts but I had to have them and probably not for the reason you expect.

Take another look at Figure 14 in the preceding item. If you look closely you'll notice that both of the binding posts have holes through the threaded part. Five-way binding posts have holes like that so you can insert wires, probe tips, etc. These are not five-ways and I drilled the holes myself, not so I could put wires in them but so I could put a small tool in, to help tighten them. (Having a hole for the wires is a bonus.)

When I bought mine I made this modification almost immediately to retain my sanity; it helps keep the binding posts from unscrewing from the meter. The one I just got at work will get it done shortly, since it has the same problem.

When assembling the meter, the binding posts have to be screwed through the front panel into threaded spacers on the PCB. There are only two ways to do that; one is to screw down the cap of the binding post as far as it will go and then keep turning to screw the entire binding post into the spacer. The other way is to remove the cap and grab the threads with a pair of pliers, which is definitely not recommended.

You have to screw the whole binding post on pretty tight so it will stay in the spacer and not come out when you unscrew the cap to connect a component. But the problem is that by screwing it in with the cap you have also screwed the cap tightly onto the binding post base. When you unscrew the cap you never know if it will unscrew from the base or if the entire binding post will unscrew from the spacer. This gets old very fast.

You need to screw in the binding post without the cap being involved. Using pliers to grasp the threaded stud allows you tighten it really well in the spacer but runs the risk of damaging the threads. That's where the hole comes in. I forget what size drill I used, but it's large enough to allow me to insert a 0.050" hex key wrench. (Or, if you prefer the trademarked name, an Allen wrench.) That is the smallest size on many hex wrench sets, although the slightly larger 1/16" size is also suitable. A small nail, brad, etc. also works.

Technically, the binding posts on the new meter I just got at work don't really need this mod, at least not for tightening them. The threaded studs on them have a pair of flats on opposite sides so you could use a pair of pliers to tighten them, although the online manual does not seem to mention this. (These appear to be cast metal instead of machined.) However, the 5-way functionality will come in handy eventually.

P.S.: Don't forget to drill the holes so the edge is as close as possible to the base. When you insert a wire you want it clamped against the base. Drill the hole up too far and the cap could damage or even shear off the wire when it's tightened.

—de WA8MCQ

Toroid Clip from a Clothespin

Holding toroids with your fingers while winding them can be a bit difficult at times. Here's a simple and inexpensive way of holding them. A couple of years ago someone posted the URL for this on the Elecraft online forum. This is the brainchild of Philip Barnes-Roberts, WA6DZS. (You can view the online version at http://wa6dzs.blogspot.com/.)

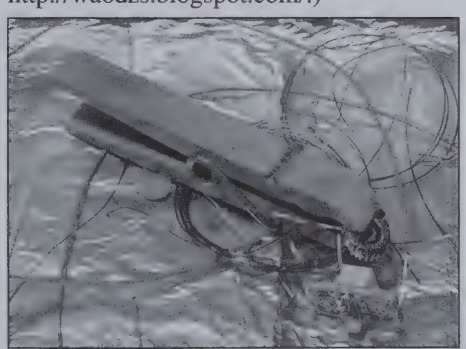


Figure 16—A wooden clothespin, slightly modified, makes a good holder for winding toroids.

I've used this handy little holder (Figure 16) for hanging onto a small toroid core, while looping the wire through it.

Essentially, start with an ordinary spring clothespin (about a buck a package at the 99c store, or even most supermarkets). Use a fresh one that hasn't lain out in the yard and started to rot; those fall apart.

I take a little Xacto mini-miter saw and cut the angle opposite what the stock clothespin uses. I don't want to slip over a shirt on the clothesline, I want to have finger room around the tip of the jaws, with the flat holding the little core. I sand down the sawn edges with sandpaper or an emery board (away from the work area) to remove any splinters.

Now grab your core and put it into the jaws, so the center hole is mostly clear, and start counting turns, pulling each one just snug as you go. Remember, one time through the doughnut hole is one turn.

—de WA6DZS

Use Bottle Top to Seal a Bag

I'm sure everyone has received e-mail that had been forwarded a number of times in a long chain and no one knows who started it. I received an interesting one recently passed along by Bruce McLincha, WB6NST. The originator of the mail and concept are unknown, but it's a very interesting idea.

This isn't exactly something that will be used a lot in the workshop, but if you operate while backpacking or other field portable operation it could be very handy, especially for extended periods such as those hardy souls who hike the Appalachian Trail with a QRP rig. There are a lot of things you might want to keep dry, such as spare batteries and matches, and this is a good way to do it. (I could not extract the photos from the mail no matter

Figure 17—Cut off the neck of a disposable plastic water bottle.

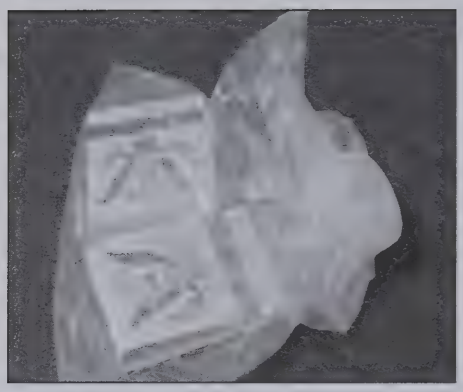


Figure 18—Put the neck over a plastic bag and replace the cap to make it waterproof and airtight.

what I tried, so I had to recreate them, substituting matches for a snack food.)

From the Mail of Unknown Origin:

Whoever thought of this should get a green medal. What a great idea. No more twist ties or rubber bands. This method is waterproof and airtight. Great! The person who first thought of the idea should be given an award for originality!

Cut up a disposable water bottle and keep the neck and top, as in Figure 17. Insert the plastic bag through the neck and screw the top to seal, shown in Figure 18. The bag is made airtight, water will not leak in, it is easy to open and the top and screw cap can be used over again!

Extra-Low-Power Pilot Light

From Frank Sanders, KN8KAZ

I keep reading about people having dead batteries in equipment because they left it on. I came across an article by Evert Fruitman in a 1984 Radio Electronics Annual titled "Extra-Low-Power Pilot Light." Since then I have been using it in most of my battery powered equipment and have practically eliminated the battery problem in my shack. I generally build

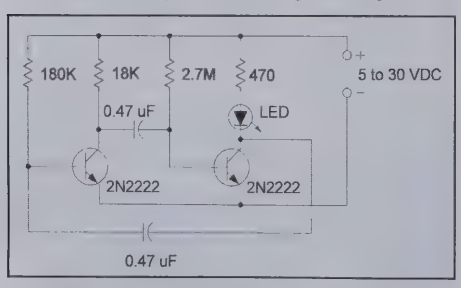


Figure 19—Schematic of the low power pilot light. You can change the blink rate by varying component values.

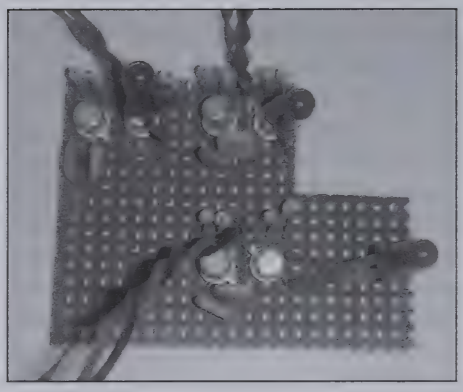


Figure 20—Three units built ahead of time for future use.

several on a piece of vector board and then cut one off when I need it. I know this is pretty old tech by today's standards but it works and works well.

Figure 19 is the schematic, and Figure 20 is a photo of three units on a Vector board that I currently have awaiting use.

—de KN8KAZ

WA8MCQ comments: Instead of being on constantly, the LED blinks occasionally so overall current drain is low. Frank later reported that it flashes about 12 times in 10 seconds and is hard to miss. You can vary the rate by changing component values.

This is basically an astable multivibrator. During most of the cycle the LED is off and current drain is very low. It briefly switches over to the other state, turning the LED on for a very short time. The current spike is much higher but the duration is short so overall current is still low and uses little battery power.

Telling Type 43 and 61 Toroids Apart

They both look alike, so how do you tell them apart if you mix up the two on your bench, or maybe throw some into the wrong bag and want to get them out of there? All it takes is an inductance meter that can measure below 1 microhenry and do it at a reasonably low frequency, such as the AADE L/C IIB, and a short piece of wire. And if you want to get fancy, you can add a banana plug or two.

Unfortunately I can't seem to find the online posts again, but someone on one of the QRP forums indicated that he had a core that be believed was either type 43 or 61 ferrite (I forget which) and was getting a far different inductance than expected. I did a bit of research with the A_L values (inductance per turn squared) of cores of both types, along with the inductance and number of turns he mentioned, and it was obvious that the core was actually of the other type. (Someone else beat me to the punch and posted his reply first.)

Since they are ferrites, which are not normally color coded like powdered iron cores, it's difficult to differentiate the two types visually. Someone said that he could tell them apart since the colors and textures were subtly different, and someone else responded that while that might be true for the particular cores he had on hand, it is not necessarily true in all cases. Since both 43 and 61 cores look alike (along with just about any other ferrite type you can think of), how do you tell them apart if they get mixed up once you take them out of the bag or box with the number written on it?

Put some wire on them and measure the inductance, then compare that to the expected value for both types of cores. Since most homebrewers are likely to have just a few different types of ferrite on hand it will be easy to tell them apart. Most common are type 61, with a u_i (initial permeability) value of 125, and 43, $u_i = 800$ or 850 depending on whether you go by the Amidon or Fair-Rite web sites (Ref. 1, 2). Although most of them have rather large A_L tolerances, ±20% or more, with the same number of turns on them the cores will show considerably different values of inductance and be easy to tell apart. (Less common are type 77, $u_i = 2000$ and 75, $u_i = 5000$. Even more uncommon, but one that I use a lot for HW-8 repairs, is type 67, replacement for the older type 63, $u_i = 40$.)

If you have just one suspect core it's

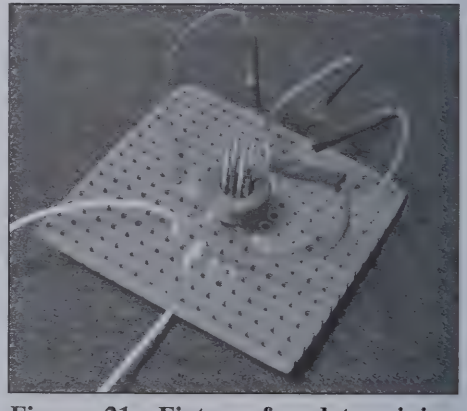


Figure 21—Fixture for determining permeability. Headers are part of 4 turns through the core. (The white wire leads add about 160 nH to the total inductance.)

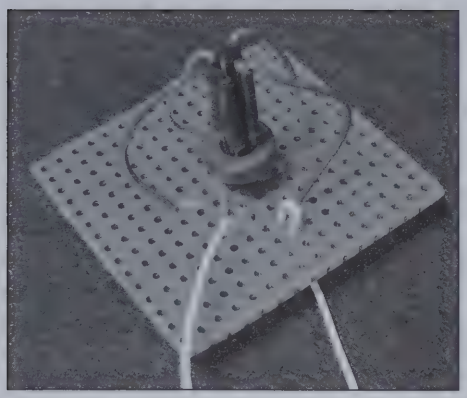


Figure 22—Wires connected to the headers complete the turns. (This fixture was abandoned early on in favor of something simpler.)

Values with 4 turns	
Core	nH
FT37-61	1096
FT37-43	4958
FT50-61	1689
FT50-43	7613

Table 1

not a big deal to wind a few turns and measure it. But if you have several to check that gets old very fast. A test fixture of some sort could speed things up considerably. Figures 21 and 22 show what I thought of first. Although it seemed like a good idea at the time I eventually gave it up for something simpler and better, described later.

Computer header pins could be used as parts of turns through a core. Put the core over the header (Figure 21), plug on wires to complete the turns (Figure 22), and measure the inductance. In order to check cores as small as FT37 only a 2 x 2 array of pins could be used, and even that barely fits the inner diameter. But I figured that 4 turns should be enough to give an easily measured value.

The wires and connectors were scrounged from an old computer cable; it was easy to push the contacts out of the plastic connector body, and I put heat shrink tubing on them for insulation. Headers come in various heights and I used the tallest ones I could find, with a nominal height of 0.418". Shorter ones wouldn't leave much room for things to make good contact, since the thickness of the core eats up a certain amount of the length.

Since the wires are rather long and floppy, their positions and spacing have some small effect on the indicated inductance, but this is not a problem. The basic concept is that we are trying to differentiate between two different types of core material which will have very different inductances for the same number of turns, and small variations in the readings are unimportant. Remember, this is not intended as a precision measurement, just a rough sorting tool to find which one of several known ballparks you are in.

Table 1 gives some typical values. Although there is some variation on all cores, there is such a large difference between the two types of the same size that it is easy to tell which is which.

The bare fixture, with no core, gave 376 nH. (The pair of 4" long leads contribute about 160 nH to the readings.)

After playing around a bit I found it to be rather cumbersome to use, and not that much better than just winding 4 turns with the same piece of wire one at a time on a number of cores. And did I really need 4 turns to get values large enough to easily tell the difference? One turn might be enough, since the AADE L/C meter IIB can easily measure down into double digit nanohenries, and it would be a lot easier.

Instead of the fixture with 4 contacts to deal with, it would take just a single piece of wire. I saw a picture once of a tester used by a manufacturer in which a stud comes down through a core to complete the circuit, giving a single turn measurement, and it obviously worked well for them. (Remember, every time the wire goes through the hole counts as a turn; it doesn't have to be wrapped around the core to count. When there is one loop on the outside of the core, it is actually two turns.)

The single turn method does require a tester capable of easily doing measurements below 1 microhenry with good resolution, and must use a relatively low test frequency. It should not be something that relies on resonating an inductor with a calibrated capacitor, such as a Q meter like the Boonton 260A or HP 4342A. The former uses a 30-460 pF variable capacitor and the latter uses 25-470 pF. A great deal of additional capacitance would have to be connected to resonate the cores at an appropriate frequency.

Although the expected values of inductance can be resonated with a capacitor of those sizes, even with the maximum capacitance the frequencies would not be appropriate for the core materials. Type 61 is specified for resonant circuits up to 10 MHz. One turn on an FT37-61 core would be 55 nH, which requires a total of 4605 pF for resonance at that frequency. If using only 470 pF the resonant frequency would be approximately 31.3 MHz, well above the core specification.

Type 43 is only rated to 1 MHz for tuned circuit use, where the 350 nH of an FT37-43 with one turn would require a total capacitance of approximately 72,370 pF. If resonated with 470 pF alone the frequency would be 12.4 MHz, again well above the upper limit of the core for resonant circuit use.

(It had been years since I tried measuring a ferrite core with a Q meter—with no supplemental capacitance—at a frequency that was inappropriate for the material so I played around with a single turn on an FT50-43 to refresh my memory. As always, it's an interesting learning experience but of little practical value. Among other things, the Q reading is very low, 5 or less, tuning is very broad, and if measured at different frequencies the indicated inductance changes significantly.)

I set the header fixture aside and started playing around with a 3 or 4 inch piece of stranded wire instead, shown in Figure 23. (There is no magic to the length; I just cut off a convenient piece but keep it

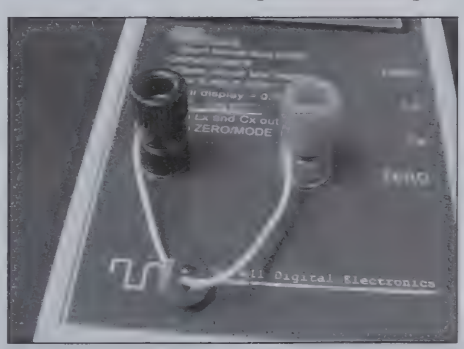


Figure 23—Checking the toroid with a single turn only requires one wire. (While this works, I finally settled on slightly more complicated methods.)

short.) It was much simpler. Connect one end to one binding post; thread a core over the wire, connect the other end to the other post and measure. Remove the core and repeat. This is as simple as it gets, although this was just an interim step. The final method is slightly more complex but easier to use when doing a number of cores.

I found that the position of the wire had some effect on the reading. It was usually roughly parallel to and about 1/4" above the front panel, but if raised up in the air it changed somewhat. However, the variation was certainly small enough that it would never cause a core to be mistaken for the wrong type, since the reading will be either somewhere around 55 nH or 350 nH. (Position of the core along the wire made no difference; it could be at either end or anywhere in between.)

Although the single wire method was a big improvement, it did have issues of its own. I was constantly screwing and unscrewing the binding post which was rather tedious, plus the stranded wire kept unraveling at the end and had to be repeatedly twisted back together. (That could have been avoided easily by simply tinning the end to hold the strands together.)

The zero point tended to drift somewhat over time so I would rezero it after every few cores. I originally used my old shorting bar (bottom of Figure 24), a piece of double sided PCB material with a pair of notches cut out to fit the binding posts. Now we have more tedium; every minute or so I'd have to remove both ends of the wire and connect the shorting bar. (Zeroing with the wire, minus core, would have been better since the wire is longer than the bar and adds some inductance.)

A plug-in bar would speed things up a lot, and allow the end of the wire to remain connected. It's another piece of double sided PCB stock with a pair of banana plugs on it (Figure 24, top).

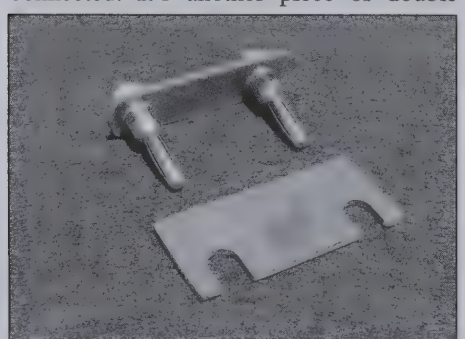


Figure 24—Shorting plug (top) and shorting bar (bottom). Both are made from double sided PCB stock.

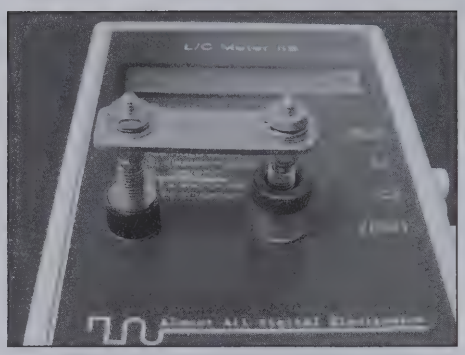


Figure 25—The shorting plug becomes a single turn fixture for a toroid. (This one is FT50.)

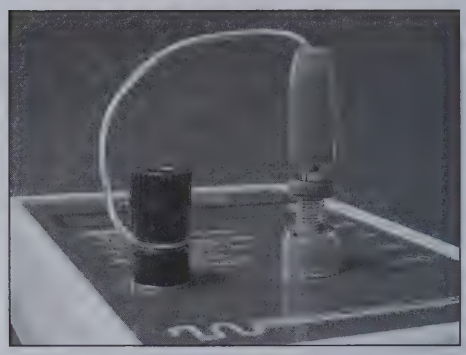


Figure 26—Another pluggable single turn option. (The FT37 core fits over the banana but not the threaded post.)

I realized almost immediately that I could toss the wire and use just the shorting banana plug bar alone. After all, an FT37 core would easily fit over the banana. I removed both plastic caps from the binding posts so the bananas could mate fully. (The caps have a bit of dead space between the threaded metal and top of the plastic, visible in Figure 23.) FT50 and larger cores fit over the threaded post or plastic base, while FT37 cores fit over the banana but not the post. Figure 25 shows it in use with an FT50 core.

For cores smaller than FT37, such as the FT23 and FT30 cores, it will be necessary to stick with the piece of wire but those sizes are probably much less common in most homebrewer stocks.

To simplify things even further—pulling out two banana plugs takes more effort than pulling one—it's back to a wire, now with a banana plug on one end. The other end is left attached to one of the binding posts (Figure 26). In this case an FT37 core is being measured. While it fits over the banana, the hole is too small to go over the binding post. (Once again, the plastic cap of the binding post is removed to allow the banana to seat as far as possible.) The meter is zeroed with just the wire, with no core.

Tabel 2 gives a rough idea of what values to expect for 1 turn on various common cores. Best results are obtained by zeroing the meter first with whatever the test conductor will be, whether wire or shorting plug. Use that as the 0 point and then add the cores. I got noticeably different values when I zeroed it with the shorting bar and then used the "banana wire" for measurements, due to the different lengths. The wire alone gave a reading of 125 nanohenries, before adding the cores. It's still possible to tell cores apart since the readings for different materials will be grossly different, but it's less confusing if the readings are similar to the published values for a single turn.

Only sizes FT37 and FT50 are shown, since those are probably the most likely ferrites to be on hand and get mixed up. If you have other sizes, you can consult the Fair-Rite web page to get the values (ref.

Core	Initial permeability (ui)	nH for 1 turn	Td.	Range, nH
FT37-61	125	55	±25%	41-68
FT50-61	125	69	±25%	51-86
FT37-43	800*	350	±20%	280-420
FT50-43	800*	440	±20%	352-528
FT37-67	40	18	+35%, -25%	13-24
FT50-67	40	22	+35%, -25%	16-30
FT50A-67	40	24	+35%, -25%	18-32
FT37-77	2000	945	±25%	708-1181
FT50-77	2000	1180	±25%	885-1475
*850 in Amidon charts				

Table 2

2). As noted earlier, I use the type 67 cores for HW-8 repairs. Two different sizes are used, FT37 and FT50A. The latter is taller than a regular FT50 and easily distinguishable.

However, finding a tall FT50 floating around my workshop doesn't guarantee that it's type 67 material. It could be some unknown core that I scrounged up somewhere; I have plenty of "faceless" ferrites of unknown material, so I would still have to check the FT50A before declaring it to be type 67. (Note—that is an improved version of the older type 63, which had the same permeability. The two can probably be used interchangeably in many applications.)

After checking a few dozen cores of various types and sizes I found that almost all of them fell within the ranges shown, with only occasional stragglers just outside the lines. The notable exception was some FT37-77 cores purchased years ago, still in the original Amidon retail packaging. Although the tolerance is 25%, the ten cores remaining ranged from 28% to 51% over the nominal value, with 5 of them at least 40% over. However, even the highest, 1431 nH, was well below 1760 nH, the lower limit of the next higher core, type 75 material (u_i = 5000, 2200 nH for 1 turn).

Keep in mind that this is not a foolproof, universal method of telling what material a particular core is, since there are so many different types out there, with many of them probably of different permeabilities and characteristics than the ones we usually use. And it's also not a precision measurement technique. It's more of a rough working tool to tell which group a particular core came from when it can be from any of the known types on hand.

— de WA8MCQ

The Fine Print

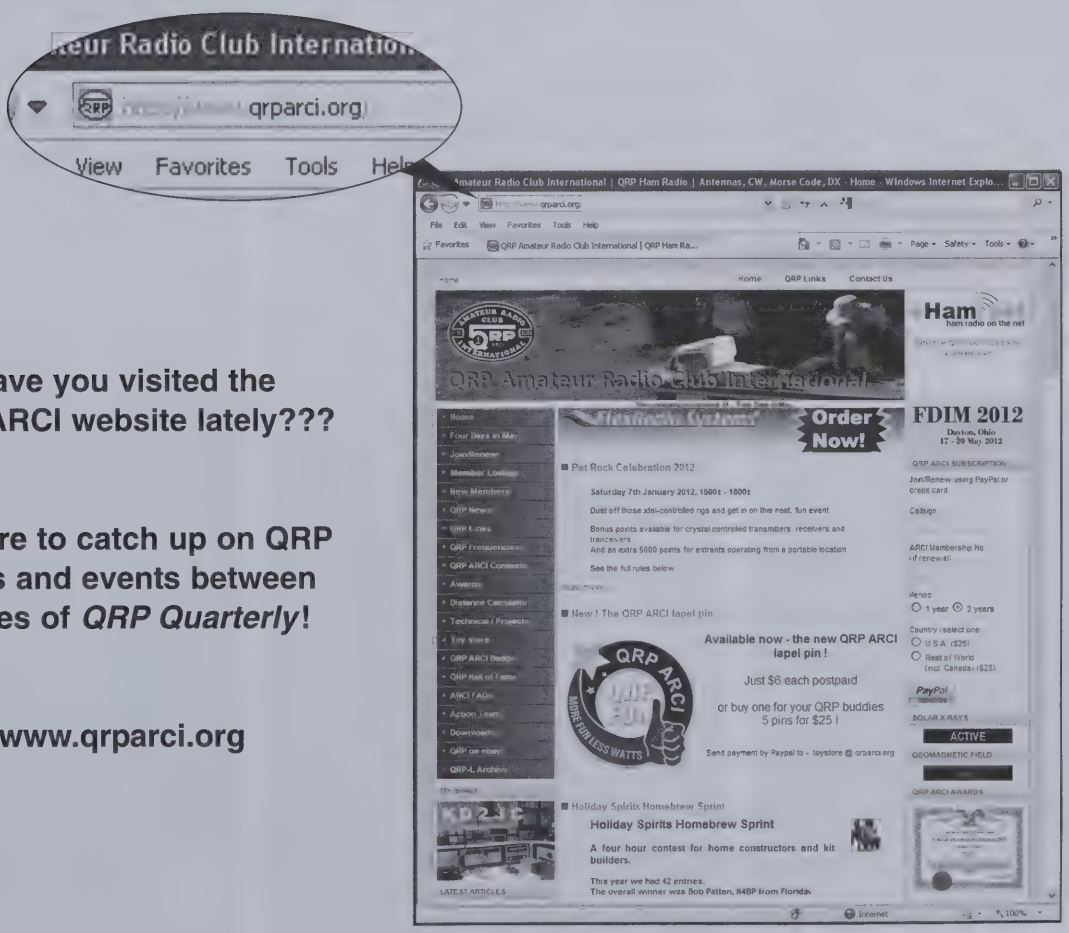
You know the drill—send your info to Severn any way you can get it here (e-mail, snail mail, floppy, CD, handwritten on a napkin, etc), or tell me where you found something of interest on the Internet. Well written, Pulitzer Prize quality articles are nice, as are computer drawn schematics, but don't worry if you can't do all that. We'll take care of the rest, editing, redrawing, etc. The readers are waiting!

References

Ref. 1. Amidon Corp; https://www.amidoncorp.com

Ref 2. Fair-Rite Products Corp. http://www.fair-rite.com; click on *Standard Ferrite Parts*, then *Inductive*, then *Closed*, then *Toroids*.

E-mail your ideas to Mike C. at: wa8mcq@verizon.net ●●


qrparci.org
View Favorites Tools
QRP Amateur Radio Club International
Ham
FDIM 2012
Order Now!
Pet Rock Celebration 2012
New ! The QRP ARCI lapel pin
Available now - the new QRP ARCI lapel pin !
Just $6 each postpaid
or buy one for your QRP buddies 5 pins for $25 !
Holiday Spirits Homebrew Sprint
A four hour contest for home constructors and kit builders.

Have you visited the QRP ARCI website lately???

Be sure to catch up on QRP news and events between issues of *QRP Quarterly*!

www.qrparci.org

QRP Clubhouse

Timothy Stabler, WB9NLZ wb9nlz@yahoo.com

Well, here it is Summer again and I am sure we all have projects awaiting. One of my biggest projects is to make sure my indoor antennas are working properly. Yes, I live in one of "those subdivisions" but the builder did run PVC pipe in the wall from the garage attic to the basement where I have my "man-cave." I really do not like walking on those board edges but I have someone who is very willing to do it for me. Meanwhile, here is the latest that I have on clubs.

East Central Indiana QRP Group:

The East Central Indiana QRP Group met in April in Muncie, Indiana. As it was the day before Easter, not many people showed up. But, for those of us that did, Richard Meiss, WB9LPU (Figure1) gave an excellent talk on keys and bugs. He had set up a table with several keys that he had made including his Roto-Bug (Figure2; Figure3). He also showed us his latest creation which had screw-in legs so it can be operated in a variety of settings (Figure 4).

He started off by saying as a kid, he built a lot as he could not afford other stuff. He did get out of ham radio for a while but in the 1990s, his wife told him he should get back into radio. And he did. Up to this time, he had never used a paddle. As a research scientist at Indiana University School of Medicine, he was using levers a lot and thought why not radio? He feels keys are just switches that can be arranged in various interesting patterns.

Richard continued his talk by showing a series of pictures of many different keys, mostly from his collection. For example, he showed a Century "Triumph" key he had recently got on Ebay. Several of the keys were from the WW II era. He then talked about keys he has made. If someone wants a key from him, their name is put on a list as each key is made personally by him in his shop. He started off using some equipment in his lab but now has his own shop at home. He told us his first shop had little more than a drill press. He did add a Harbor Freight metal lathe on which on can only approach changes in one direction. He now has a newer lathe and small mill.

The second half of the meeting was spent by each person talking about their latest projects. The next meeting will be held October 6. You can contact me or Donnie Garrett, WA9TGT, at cfzepp@gmail.com for details.

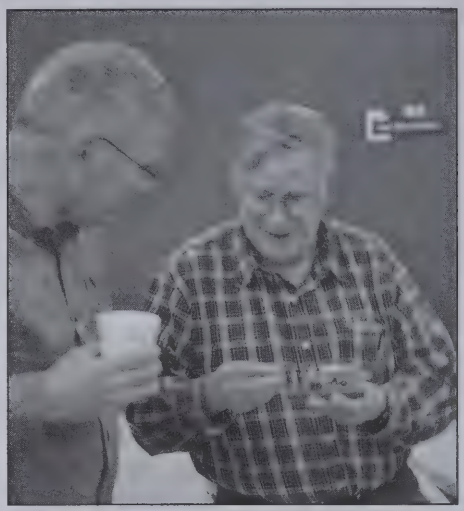


Figure 1—Richard Meiss is shown discussing one of his keys

Figure 2—Table set up showing keys that Richard Meiss has made

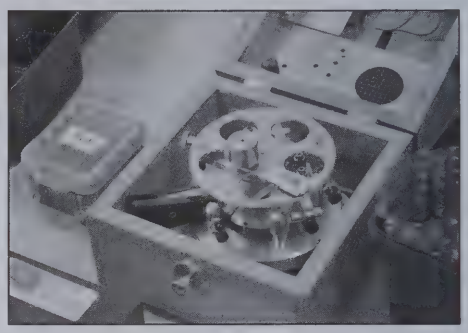


Figure 3—The Roto-Bug, made by Richard Meiss

Ozarkcon, 2012:

Again, this was a very good meeting. I got to the hotel Thursday afternoon, which allowed me to wander around town before the meeting beginning the afternoon. Yes, Branson had been hit by a tornado, but our hotel was untouched. Some other hotels, however, had been hit. To me, it was very strange to see a small strip mall flattened with the buildings on either side untouched.

Friday afternoon, the meeting began with registration at 4 PM. Vendors had set up their wares. The dummy load QSO party began, which went until the end of the day Saturday. This party also included making contacts with the special events station at the Titanic museum. The areas were open for entries into the wacky key contest and the homebrewing contest. At 6:30 dinner was served buffet style. After dinner, Jim Kortge, K8IQY, gave a talk on "Returning Ospreys in Southern Michigan" (Figure 5). The osprey is a fairly large bird, weighing 3-1/2 to 4 pounds and having a wing span of 5-6 feet. Their

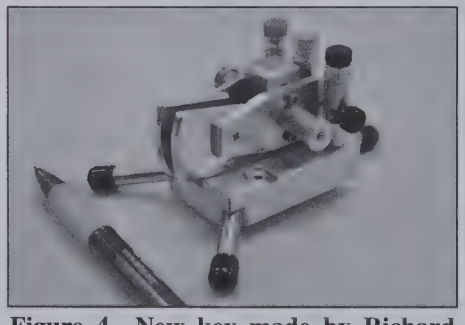


Figure 4—New key made by Richard Meiss, WB9LPU, showing a pen for size reference.

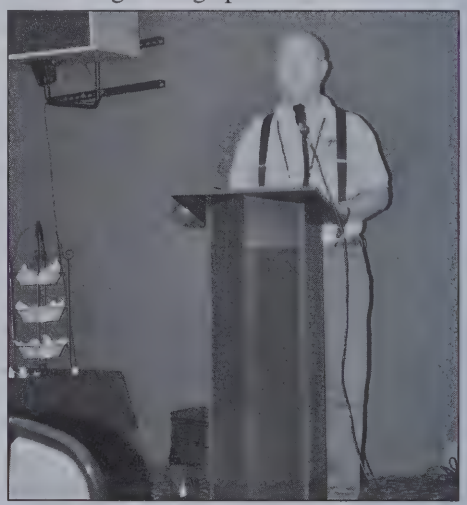


Figure 5—Jim Kortge, K8IQY, speaking on returning ospreys.

main diet is fish and they will dive into water 3 feet deep to get a fish. Use of DDT did the birds in. Although it is not likely to repopulate the birds at their earlier population levels, work is going on trying to get some back.

In 1998-230023, chicks were placed and raised where naturalists wanted them. Using telemetry, chicks were found to range 15 miles from, their original nesting site. Normally, birds will find a nesting site and continue to use it for years. Mating is for life. When the bird is able to fly, they will migrate about 3800 miles to South America where they will spend a year or two before migrating back. One bird from 1998 did migrate back in 2001. A nest was built in Southern Michigan, the first in about 70 years, and a chick was born. Although many chicks have not returned, nesting sites that have been used have seen an increase in the number of chicks born.

The people working on this project have a website at www.owsem.org. Much information on the bird is found there.

Following the talk, some people went to the kit building workshop supervised by the Midwest Homebrewers QRP Club (Figure 6). This year's project was an active audio filter. I did attend the workshop and did a kit. Using capacitors with European numbering did slow me down a bit. That evening, the vendor fair and swap meet was open. Some people got together about 9 with their instruments for an evening of music.

On Saturday, the talks were held. Terry Fletcher, WAØITP, and Ron Potter, AG12P, welcomed everyone to the meeting. They then introduced Fire Chief Martin (Figure 7) who welcomed the group to Branson and went over what Branson has to offer. He hoped everyone felt at home as the town is family oriented. He talked about how he had gotten into ham radio but did admit he had to look up "QRP". He felt education was very important and relationships started with students.

The first talk was on "The Iowa High Altitude Balloon Project" and was given by Marshall Diaz, WØOTM (Figure 8). Marshall concentrates on near space, 65,000-325,000 feet in altitude. A 1.5 watt transmitter is placed in the balloon payload for tracking and the beacon can be turned on and off. Lately, they have been working on launching a glider from the balloon from various heights to pilot the back to the original launch site. A video camera has been placed in the nose of the glider. An early problem was that the glider ended up in a crop field and could not be seen. Another project has been working on autopilots to release a parachute when the balloon has burst and the payload is on its way down. Various projects continue to be worked on. Marshall has found out that students love the balloon stuff and he encourages them to put experiments in 35 mm film canisters to be placed in the payload on the next flight.

Figure 6-The kit building workshop showing Darrel Swenson, KAØAWB, discussing the build with a participant

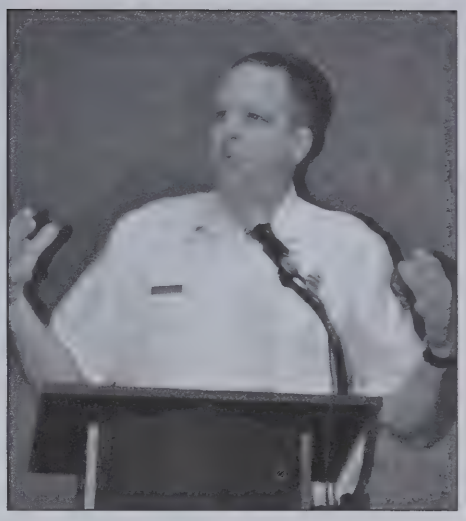


Figure 7—Fire Chief Martin welcomes the Ozarkcon group to Branson

The next talk was "POW Clandestine Radio by David Cripe, NMØS (Figure 9). During the depression, when money was very tight, people needed to improvise on radio equipment in order to get it to work. As a result, a native class of electronics people was developed as this was their way to get off of the farm. Some of these people went into the service and the WW II began. In the pacific, some of these people were captured by the Japanese and put into POW camps where treatment was not always that good. POWs were kept in isolation and fed stories how the US mainland had been invaded. POW groups were forced to do very hard work including digging graves for POWs that had died in camp. Russel Hutchison was a POW and always was searching for radio parts. He had told the Japanese he was a radio expert and they used him for some radio work. He did manage to get some parts and built a radio receiver in a hollow 2 x 4. He had

Figure 8—Marshall Diaz, WØOTM, talking on his Iowa High Altitude Balloon Project.

Figure 9—David Cripe, NMØS, during his talk about POWs making radios during WW II.

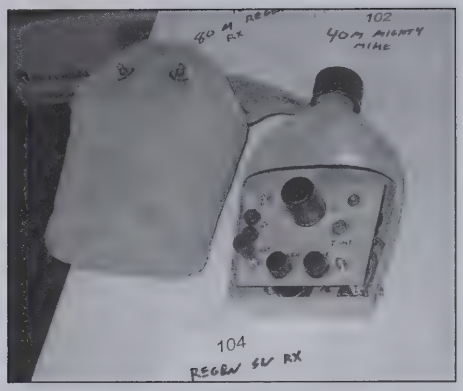


Figure 10—The canteen radio made by David Cripe based on WW II information.

found out he could get power from the latrines. He then put radios in cans so they could be moved with prisoners to new POW camps. William Gibson documented Hutchison building a radio in a canteen, which got left behind at the end of the war.

David wanted to look at this type of radio. He found an army canteen on Ebay and an old radio he could use for parts. He suspected Hutchison had used a Hartley oscillator as it would need fewer parts. He put together his version of the canteen radio and found out it works quite well (Figure 10).

The next talk was "Radio Astronomy" by Phil Anderson, WØXI (Figure 11). In radio astronomy, one really is looking at the heat from a body. The receiver turns this "heat" into noise in the radio. A wide range of frequencies have been used for this work. The temperature of a star is based on a resistor. The hotter the resistor, the more noise it generates. The hotter the source, the more watts/square meter. Brighter stars are easier to hear. There is the problem of gain because stars are so far away. Competing with the noise from the star will be background noise received and noise generated by the antenna, feed line noise and generator noise. Phil has a book on radio astronomy available from the Xtal Set Society, Inc. (www.midnightscience.com).

Figure 11—Phil Anderson, WØXI, speaking on radio astronomy.

Following a break for lunch, the afternoon started with a talk by Nick Kennedy, WA5BDU (Figure 12). His topic was "Intro to LT Spice". He asked the question that for those of us into homebrewing, how accurate is LT Spice? Actually, it is quite good for many things although non-linear circuits may need some tweaking. LT Spice is a high performance SPICE simulator, schematic capture and waveform viewer with enhancements and models for easing the simulation of switching regulators. The program comes from Linear Technology (www.linear.com). One can look at DC voltages against time or for AC analysis look at frequency response of passive and active components. One can use the program as a simple drafting tool and see data plotted. Nick went over the basic toolbar and put a circuit together while talking although, as he mentioned, there was no model in the program for a transformer. Maybe this has changed with the latest revision of the program.

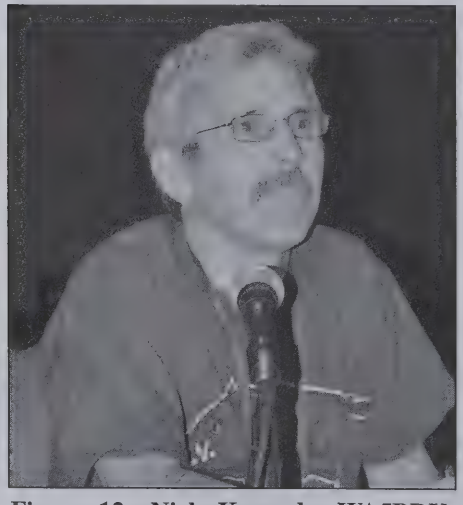


Figure 12—Nick Kennedy, WA5BDU, presenting his talk on LT Spice.

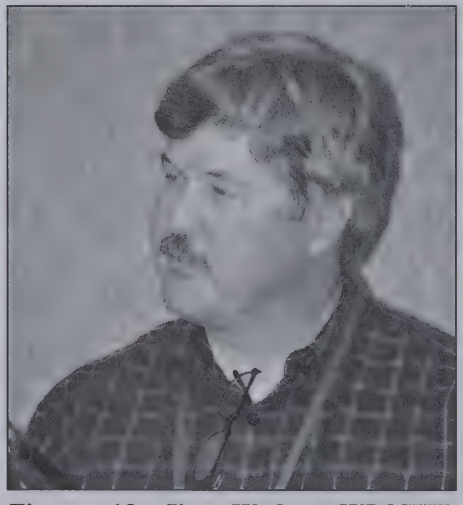


Figure 13—Jim Wades, WB8SIW, speaking on telegraphy.

The next talk, "Canst Thou Send Lightnings" was by Jim Wades, WB8SIW (Figure 13), who spoke on telegraphy. Very early, if you wanted to get a message to somebody, you had to carry it there or have someone take it for you. Telegraphy changed all of this. The telegraph and railroads grew together. News syndicates were started. All areas began to grow. Commodities became national as well as international. Duplex and multiplex circuits became available so that multiple signals could be sent on the same wire. Morse code was developed by Samuel Morse and Alfred Vail and was used for railroad and other land telegraphy. Some offices were small and had few circuits. In larger corporations, hundreds of operators were employed for a multitude of jobs. Sports announcers really did not travel that much, getting their information by telegraph as they sat in their studios and gave the play by play. The telephone did not replace the telegraph as the telegraph could have multiple carriers on a single wire. In the 1920s, the teletype became practical. Western Union was efficient and inexpensive. This served as a model for the Bell System. Telegraphy is unique as technology and unique in American history.

The last talk of the day was "Construction Techniques and Hints" by Joe Eisenberg, KØNEB (Figure 14). Joe has been building electronic gear since he was a child. In high school, he built a Scout. He feels the number one item for anyone to have is an assortment of parts. Other nice things to have available include a variable power supply, an oscilloscope, a frequency counter, a dummy load, a vacuum desolder apparatus, a random wire antenna, a solder roll holder and, of course, a AM-FM radio to listen to. He pointed out that the Plano 1354 tackle box is great to hold an assortment of parts. One needs to

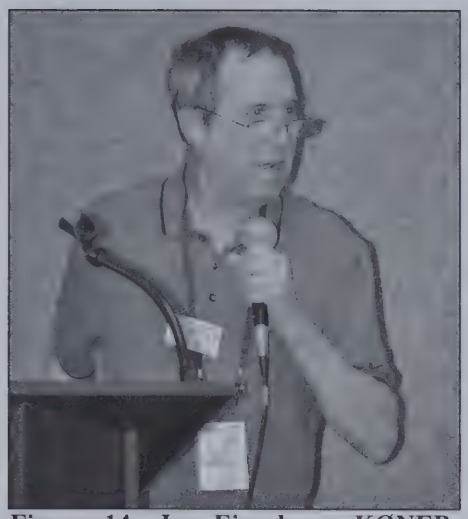


Figure 14—Joe Eisenberg, KØNEB, telling everyone what to think about during home building electronics.

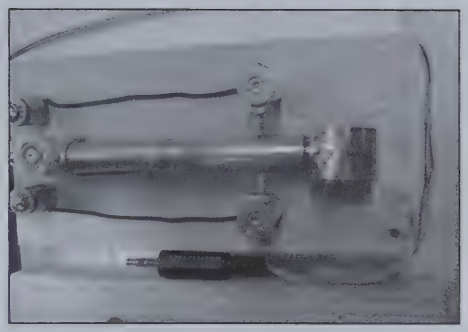


Figure 15—Mert, WØUFO's unique rifle shell key.

Figure 16—The Ozarkcon evening musical group

co troll the temperature of your soldering iron and spoke of a light dimmer project he had constructed to control soldering iron heat. He then spoke of hints he has found useful in soldering such as using the sharpest wire cutter available to trim after soldering. He likes to use a cookie sheet when working on a project as parts tend to stay on the cookie sheet and not get lost somewhere. He also suggested using a good magnifier with good lighting to see while you work. He told the group not to be afraid of surface mount parts and to follow toroid instructions carefully. His constructions tips include removing any distractions while working, reading the manual carefully, using a cookie sheet, having a power supply available and, of course, having a supply of parts. Joe writes the construction column for *CQ* magazine and has done a wealth of kits and scratch-built items.

At the end of the presentations, an auction was held and the Ameco AC-1 was taken home by Rich Arland, K7SZ. The best of show award went to David Cripe, NMØS for his canteen radio. The wacky key contest was won by Mert Nellis, WØUFO. His winning key had been made from empty (fired) rifle and pistol cartridges (Figure 15). The grand prize was drawn and won by John Hoaglun, NGØR. The prize was a Ten Tec 4-band transceiver. That concluded the day. The vendors did stay open for a while and later that evening another music session was held (Figure 16).

North Georgia QRP Club Build-a-thon:

Here is a report submitted by Phil Graitcer, W3HZZ. Photos are by John Cummins, AD4S.

Saturday, April 28. It was perfect day to activate a new summit, set up a station in the park, take a walk, or even mow the grass. But instead of outdoor activities, 13 intrepid NOGAnauts—all members of the North Georgia QRP club (the QRP club without dues, officers, and rules)—set up shop in Pickett's (AD4S) Palatial Basement Building Palace to tackle putting together an end fed half wave antenna tuner (EFHW).

Phil, W3HZZ, built one and used it in the field with his AT Sprint 3b. Now that several new tiny rigs from Ten Tec, Elecraft, Steve Weber, and Hendricks were coming on the market, and it wouldn't be long before owners of these rigs would need an antenna and tuner for the field. The EFHW tuner, also known as a SOTA tuner, created by Stu, KI6J, has an SWR bridge, an LED for tuning, and comes with a predrilled project box and BNC and post connectors (betterqrp.com).

Several of the NOGAnauts had never built a kit before, and one or two confessed to being a little apprehensive as the build date rolled around. That tension mounted as Phil and Pickett, leaders for the build, told the builders to open their envelopes and fire up their soldering irons. It wasn't long before the builders were crawling on the floor looking for a toroid core that had rolled away or a diode that had dropped or a screw that had launched into space. But within four hours—with the help of good instructions, a BBQ break at the Down Home Restaurant and fortified with a couple gallons of coffee and a couple dozen of Krispy Kreme donuts, everyone turned in a perfectly working tuner—one that checked out on the 40, 20, and 15 meter bands.

No tuner build is complete without a new antenna and everyone went home with and a camping clothes line pulley and—thanks to Jim W4QO—a couple of 34 foot hunks of telephone hookup wire, perfect for that 20 or 40 meter end fed antenna.

Builders included Ade KJ4CUY, Mike KF4UPO, Brian WD4DX, Sid N4NQ, Dave AK4AI, Phil K4PQC, Rich K7SZ, Clark WU4B, Newt N4EWT, Dr. Bob AA4CX, Mike KD4SGN, Dick K2UFT, and Lawyer Bob KI4GHT. Expect to hear these NOGAnauts with that "/P" on their call. A special thanks to Stu, KI6J, for providing the kits.

Minnesota Amateur Radio Technical Society:

As I stated in my Spring column:December was the last meeting of the Minnesota (MN) QRP Society. The December meeting was the last official meeting of the MNQRP club as there wereno volunteers interested in assuming the board positions. At that meeting it was proposed to form a new club that would be properly registered with the state and have a constitution/bylaws that would permit changes when necessary—not to mention obtaining necessary liability insurance. The focus of the new club will continue to be the technical aspects of Amateur Radio including, but not limited to, CW QRP. The new name is above. The new group seems to be doing well. I get their monthly newsletters. Their website is www.mn-arts.org. Although they do not want to be necessarily a QRP club, I hope to hear from them in the future.

I guess that is about it for right now. Please send me information on your club and what you are up to.

—72, Tim, WB9NLZ

●●

Buddistick Vertical Antenna Tests

Michel Boissonnault—VE2TH ve2th@videotron.ca

With the good advice of Budd, W3FF and the owner of Buddipole, I ordered some new mini-coils and an adjustable shock cord whip (model RSAW 4/22) for my Buddistick vertical antenna. I have been using Buddipole & Buddistick products since the beginning back in 2003. We use them exclusively during the summer in camping trips doing portable all around the country and year round at home in mono-band configuration. Budd, Chris W6HFP and all the personnel should be congratulated for giving the ham fraternity the possibility to play radio, have fun and have an easy way to operate during all kinds of emergencies.

Why pick this particular model of whip? Budd told me it is his favorite, mainly because you need only one whip to work on high bands. This whip is 22 inches collapsed, 85 inches extended, and 121 inches extended plus the base/stinger. Now, 86 inches is a bit less than 8 feet. Pull out the stinger on top by less than a foot and you have the 8 feet of whip required to resonate on 10 meters. By pulling the top whip up all the way you have about 9 feet, and that's good for 12 meters. (Assuming you are adjusting the single elevated radial to get resonance for each band change). To go to 15 meters, you can pull the top stinger out all the way and the bottom stinger enough to get you to 11 feet, and that's what you need vertically for that band. 17 meters requires another 2 feet approximately, and one accessory arm which comes with the Buddistick does the trick nicely. Adjust the radial to 12-13 feet, and you are good to go. Now for 20 meters, you probably would want to insert a coil on top of the Versa Tee and tap that coil with the idea of lengthening the vertical, (same length you used on 17 meters) and then using a radial of about 15-16 feet to get resonance on that band.

Well, the parts came a couple of weeks ago and it is now late April. Our weather is a bit better and warmer now here at my home QTH in Quebec City, Canada. So, I decided to do some tests with my Buddistick vertical antenna and its new mini-coils and adjustable shock cord whip.

My lot is small. In back of the house, my lot is 70 feet long by only 43 feet foot wide. Around this part of my lot is a chain link fence with fence posts fixed in concrete 4 foot deep in the ground. The fence is 4 foot high on one side and 5 foot high on the other side. So 2 x 70 foot plus 43 feet wide = 183 feet. What a nice counterpoise, isn't it? So for home use, I decided to use this fence as a counterpoise instead of the usual single radial. It gives me the opportunity to use this support all year long to make several tests with various Buddipole parts, such as regular Buddistick, and later full length vertical using long whips, and regular longest shock cord whip plus arms down to 20 meters. Fortunately, the only power lines nearby are the ones carrying electricity to my house from the wood pole which is at around 140 feet from my lot. So those are the only wires and they are on the other side of the lot.

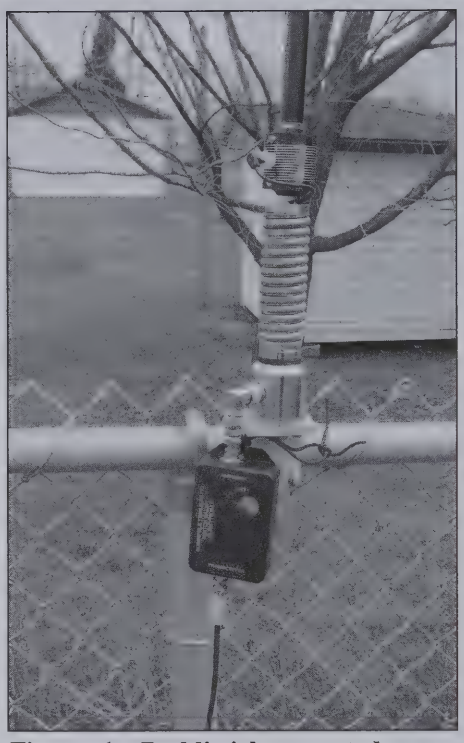


Figure 1—Buddistick mounted on a chain link fence. The box below the feedpoint is the Triple Ratio Switched Balun.

Five years ago, a friend of mine built up for me some kind of bracket to fix it up on the top tubing of the fence, as shown in Figure 1. What we do not see on the photo at the back of the bracket is that instead of putting regular nuts, I put stainless steel wing nuts. It is faster to install. By the way, the black gadget below the bracket is a Triple Ratio Switched Balun (TRSB), also from Buddipole. By the way the TRSB is very good. It passed the very cold windy, snowy Canadian winter without problems. The only precaution we took, my XYL Georgette VE2RH wrapped it solidly with two zip lock bags and tape.

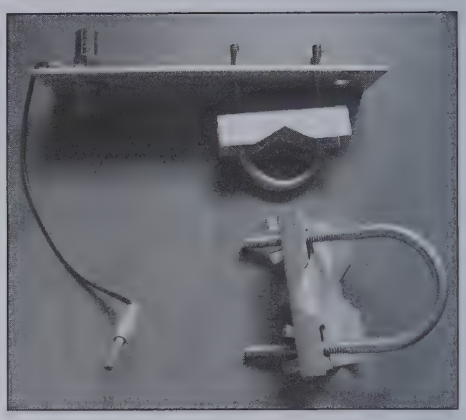


Figure 2—Detail of fence clamps.

Since that time, I have another bracket for portable use. Figure 2 is a close up of the two brackets. The biggest U-bolt with wing nuts is used for bigger top tubing of the fence when required. So each time when portable somewhere, if I have the opportunity to have such a fence in a park, I do not hesitate. I hook up my base and antenna always if there are no power lines around. If you have a similar fence in areas you use for portable operation, be sure to try a setup like mine. I'm sure you will like it very much. OH! I'm also sure that this antenna would work very well if you can hook it up to a balcony rail.

Now the fun began with the test of those new parts! For this new vertical I used the following parts:

- Adjustable shock cord whip model no. RSAW 4/22
- 22 inch long arm
- Mini coil
- Triple Ratio Switched Balun

Figure 3 shows details of the test setup. The BIG Spring, is from Outbacker anten-

Figure 3—The antenna mounted and ready for testing.

Figure 4—20M test setup. You can also see how the antenna is mounted to a heavy spring.

Table 1		
Band	Test Frequency	SWR
20 Meters	13.994 MHz	1.1:1
	14.200 MHz	1.05:1
	14.352 MHz	1.2:1
17 Meters	18.067 MHz	1.15:1
	18.166 MHz	1.1:1

Table 1—SWR measurements.

na, which is generally used to be a solid support for the longest Outreach antennas. In the field, I use a smaller 4 inches stainless steel spring, or I simply screw the base of the arm directly to the base. The coaxial cable is RG-8X, 25 feet long with BNC connectors at both ends. It is easier to hook up to the TRSB. No adapters like BNC to PL-259 needed.

For the test, I put the coil first. I tapped it at 7 turns with the whip completely collapsed. It resonated on the higher part of 20 meters. I lengthen the whip at the base by 2 inches as shown in Figure 4, and then Bingo! The antenna was in the ballpark and it covers the, entire band below 1.2 to 1 of SWR. See Table 1 for some example test figures. The TRSB was at the 2:1, 50 to 25 ohms setting because the base of the antenna is very close to the top supporting fence pipe. Sure when I will try this same configuration in the field, with elevated radial, the settings shall be very different and according to my own experience the TRSB shall be at the 1:1 setting as usual. For 17 meters, I lengthen the whip by an additional inch = 3 inches total instead of 2 inches and put only 4 turns instead of 7. Bingo! The entire band is covered as you can see in Table 1.

Well this is what I did today, I could have made more tests, but the rain and wind were coming in. Anyway, warm and sunny days shall be here soon, and we have plenty of time to make dozens of other tests.

Since I made these tests, I have had some time to operate with this antenna and learn how it operates on the air. You bet the results are fantastic! Running QRP CW with the FT-817ND or my Icom IC-703+ and this antenna, I work regularly lots of DX all around the world. I worked last week, JM7OLW in Japan, for 6,285.55 Miles or 10,115.61 km. And there have been many others, especially many Europeans & South Americans, plus all over the US including Alaska and Hawaii.

—72/73/88, Michel VE2TH and Georgette VE2RH

●●

QRP ARCI Contests for 2012 — *Get on the Air!*

Welcome to QRP
25 August 2012
1500Z to 1800Z

The Two Side Bands Sprint
USB (10m, 15m, 20m) and LSB (40m, 80m), 8 & 9 September 2012

USB: 1500Z to 2100Z on 8 September, and 1500Z to 2100Z on 9 September
LSB: 2100Z on 8 September to 0300Z on 9 September, and 2100Z on 9 September to 0300Z on 10 September

Fall QSO Party
13 & 14 October 2012
1200Z on 13 October 2012 through 2400Z on 14 October 2012.

Top Band Sprint
29 November 2012
0000Z to 0600Z
Note: this is the evening of 28 November 2012 in North America

Holiday Spirits Homebrew Sprint
16 December 2012
2000Z to 2359Z

How Efficient is Your QRP Small Loop Antenna?

Amir Findling—K9CHP (sarlabs@gmail.com) and Kazimierz "Kai" Siwiak—KE4PT, (k.siwiak@ieee.org)

These days, many hams have space restrictions and covenants to contend with in setting up a station at home. Other hams, particularly those who favor QRP, have taken to the field to do their operating. Both situations would benefit from a highly portable HF antenna with wide frequency coverage, such as the small loop antenna discussed here.

In 1970, John H. Dunlavy, Jr. discovered and patented the principles of constructing a small and efficient HF transmitting loop that can be tuned over a wide frequency range [1]. Many hams homebrewed, and several manufacturers including MFJ, AEA, and AlexLoop, produced small (approximately 1 m diameter) HF loops based on Dunlavy's now-expired patent. We are interested in QRP, so we want to know the efficiency of the small HF loop. You can easily estimate the efficiency of your loop antenna from a simple measurement of the antenna Q along with a few easy calculations. Here's how to do it...

It's Just a Simple RCL Circuit

A small loop having inductance "L," resonating capacitance "C," and resistance "R" resembles a series RCL circuit. The resistance includes both the radiation resistance, which relates to the amount of power actually being transmitted into space, and the loss resistances of the loop, which relates to the amount of power lost in heat. Dunlavy's discoveries centered around techniques for reducing the loop losses while providing a novel secondary loop to feed the main loop. His invention enabled loop antennas that could be tuned by a simple series capacitor over a frequency range of as much as a 10 to 1, while maintaining a constant match to the feed line through a secondary feeding loop. Ham versions typically can cover 7 MHz through 30 MHz.

The Key is the Q

Three components make up the Q of the small HF loop: (a) the Q_{RAD} of a perfectly conducting loop having just radiation resistance R_{RAD}, (b) the Q_{RES} due to the loop loss resistance R_{LOSS}, and (c) the Q_{CAP} of the resonating capacitor C_{LOOP}. Qs can be combined according to the formula:

$$Q_{TOTAL} = \frac{1}{\frac{1}{Q_{RAD}} + \frac{1}{Q_{RES}} + \frac{1}{Q_{CAP}} + \cdots}$$

The trick in finding the efficiency involves first measuring Q_{TOTAL}, then computing the ideal Q_{RAD}. The efficiency, as described in Section 11.4.6 of [2], then takes the form,

$$Efficiency = \frac{Q_{TOTAL}}{Q_{RAD}}$$

where K9CHP measured Q_{TOTAL}, and KE4PT calculated Q_{RAD}.

Measuring Q, the Eclectic Parameter

Many different but exactly equivalent formulas express the value of the factor Q, see [3]. We use a few of these formulas below, starting with the "bandwidth formula":

$$Q = \frac{\sqrt{F_U F_L}}{F_U - F_L} = \frac{Frequency}{Bandwidth}$$

We must find the 3dB bandwidth frequencies F_U and F_L. If we can measure antenna impedance directly, then find the upper frequency F_U where $R = X$, and next find the lower frequency F_L where $R = -X$. Alternatively and equivalently, you can find those same upper and lower frequencies for VSWR=2.62:1, or Return Loss = 7 dB. Once we know F_U and F_L, we obtain the measured Q from Equation (3).

Estimate Q_{RAD} from the Loop Impedance

For the ideal loop, the radiation resistance is the only "loss". First, find half the ratio of the ideal loop reactance to the loop radiation resistance. Formulas abound for the theoretical loop impedance, but we applied the formula of Equation (4) which is based on one half of the loop reactance divided by the radiation resistance from Section 11.4.1 in [2],

$$Q_{RAD} = \frac{3\left(\ln\left(\frac{8b}{a}\right) - 2 + \frac{2}{3}(kb)^2\right)}{\pi(kb)^3\left(1 + 8(kb)^2\right)\left(1 - \left(\frac{a}{b}\right)^2\right)}$$

Here $k = 2\pi/\lambda$ is the wave number, where λ is wavelength, b is the loop radius, and a is the loop conductor cross-sectional radius. Use the same units for all dimensions. Formula (4) includes first order dipole-mode contributions to Q. Alternatively you can find the loop impedance $Z = R_{RAD} + jX_{LOOP}$ (without the resonating capacitor) by using NEC (Numerical Electromagnetic Code). But don't forget to use perfectly lossless wires in the model and omit ground reflections. Then apply another equivalent expression for the ideal loaded Q,

$$Q_{RAD} = \frac{X_{LOOP}}{2R_{RAD}}$$

Calculate and measure Q on your ham bands of interest and finally apply Equation (2).

The Results

We applied the above technique to find the efficiency of a 36 inch diameter loop constructed from a section of RGC-213 coaxial cable and marketed as the

Band	F_U	F_L	Q_{MEAS}	Q_{RAD}	Efficiency, dB
10m	28.993	28.775	132.49	160.65	-0.84
12m	25.007	24.880	196.40	265.95	-1.32
15m	21.273	21.182	233.27	457.72	-2.93
17m	18.160	18.096	283.25	770.00	-4.34
20m	14.188	14.146	337.31	1702.7	-7.03
30m	10.138	10.111	374.98	4882.7	-11.15
40m	7.159	7.140	376.29	14223.3	-15.77

Table 1—Measuring the efficiency of a small loop.

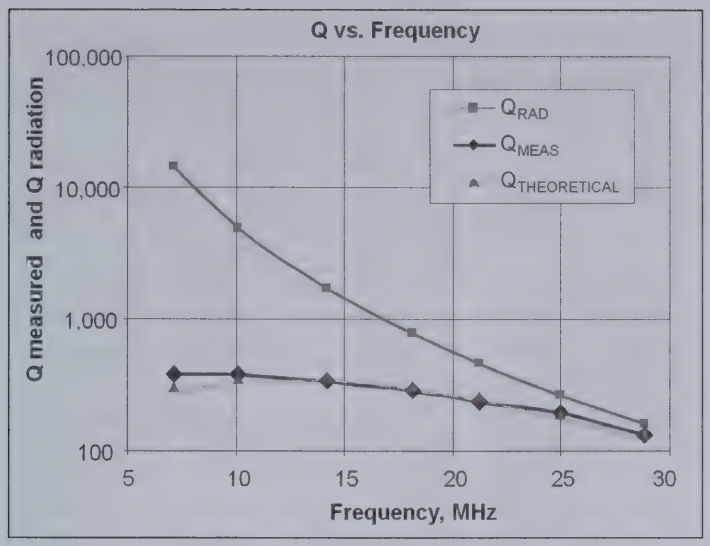


Figure 1—Measured, theoretical and ideal radiation Q versus frequency.

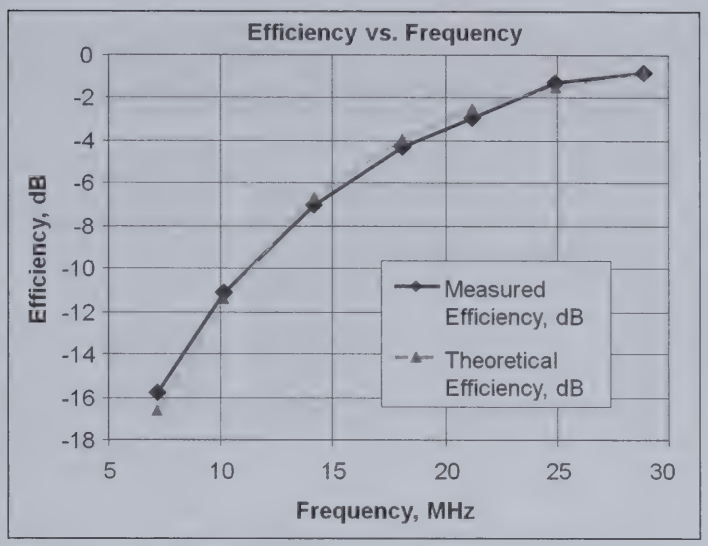


Figure 2—The efficiency of a small HF loop drops dramatically as frequency is lowered.

AlexLoop Walkham, Portable Magnetic Loop Antenna by PY1AHD. Table 1 reports the details of our measurements and the calculation of Q_{RAD} and *Efficiency* in decibels (dB).

We can see in Figure 1 that the loop Q decreases with increasing frequency and that the spread between the ideal Q_{RAD} and measured Q_{MEAS} increases as frequency drops.

Figure 2 shows the measured loop efficiency (solid curve), which is the ratio of Q_{RAD} to Q_{MEAS}, expressed in decibels. We also calculated and plotted (dashed curve) the theoretical Q ($Q_{THEORETICAL}$ in Fig. 1) and theoretical efficiency of a loop having 10% of the conductivity of copper. We see that the measured efficiency behaves like a theoretical loop, having 10% the conductivity of copper. This is consistent with the loop construction since the outer conductor of RGC-317 comprises tinned copper braid over aluminum foil. This small loop is just a little more than an S-unit down from perfect efficiency at 14 MHz and steadily improves with increasing frequency. In the 40m band, efficiency is still useable. Note that the 3 dB bandwidth (VSWR<2.62:1) is just 19 kHz within the 40m band and increases steadily to nearly 220 kHz within the 10m band.

In Summary

We found the efficiency of a small HF loop antenna by calculating the ratio of measured Q to theoretically ideal Q. Our results are consistent with expectations for a loop constructed from RGC-317 coaxial cable. The same high Q which results in efficiency also means that the loop needs retuning when changing frequency, even slightly. One of us (K9CHP) is flirting with the 1,000 watts per mile level on European QSOs, and has worked all over W and VE land using the small HF loop. Our measurement technique works well with small HF loops and may also be applied to other types of antennas.

Finally, we'd like to thank Dai, KE4QXL, for reviewing and editing this article.

—73/72, Amir, K9CHP and Kai, KE4PT

Who We Are

Amir Findling, K9CHP, holds an Extra Class amateur radio operator license and an active QRP membership #14,430. He is heavily involved in K9 Search and Rescue, and his call sign memorializes his first Search and Rescue dog "Chip". Amir enjoys DXing, "relaxed contesting", operating QRP, and has earned the WAC and WAS Awards. He holds memberships in ARRL and volunteers as a VEC for both ARRL and W5YI. He counts mobile, portable and maritime mobile operations among his amateur radio pastimes, and enjoys phone, digital modes (PSK-31 and RTTY) as well as LEO satellite operations. Amir earned his Graduate Degree in French Linguistics at Indiana University.

Kazimierz (Kai) Siwiak, KE4PT, an Extra Class amateur radio operator and QRP ARCI membership (#2194) earned a Ph.D. in electrical engineering. He consults in intellectual property and in antennas and radiowave propagation. Kai is a life member of AMSAT and an ARRL member where he serves on the RF Safety Committee and is a Technical Advisor. Kai is an avid DXer and earned WAC on 8 bands, DXCC and WAS-TPA from his low power station and indoor attic antenna. On travel he packs an HF QRP "DX-go-bag" station with which he's earned the "1,000 Miles per Watt" award. As former team member of SAREX (Space Amateur Radio Experiment) he facilitated many SAREX operations and school contacts. His other interests include flying (instrument and multiengine commercial pilot), hiking and camping.

References

[1] John H. Dunlavy, Jr., "Wide range tunable transmitting loop," U. S. Patent 3,588,905, issued 28 June, 1971.

[2] K. Siwiak and Y. Bahreini, *Radiowave Propagation and Antennas for Personal Communications*, Third Edition, Artech House, Norwood MA: 2007.

[3] K. Siwiak, "Q and the Energy Stored Around Antennas", (to be published mid 2013), *QST*.

●●

VHF QRP: How to Find VHF Openings

James Duffey—KK6MC JamesDuffey@comcast.net

The VHF bands are notorious for being dead much of the time and then actively opening for a short time, then closing again as quickly as it opened. The key to having fun on the VHF bands is knowing when the openings occur and how to take advantage of the opening when it occurs. There are many techniques to use to find openings. Here are a few ideas to get you started.

Listen

In these days of nearly instant communication by the internet, more on that later, listening is becoming a less commonly used technique to find openings. Don't get caught up in this bad habit. The internet resources should complement and supplement the calling frequency, not replace it.

Listening on the calling frequencies is a time honored technique for finding VHF openings, and is still effective. When you are in the shack, tune your VHF rig to the one of the calling frequencies. If the white noise bothers you, set the squelch on lightly. If there is any activity on the calling frequency you will hear it and be prepared to work it.

You should also monitor the beacon bands for signs of openings. Sometimes you will hear a beacon before anyone comes on the calling frequency. If you hear a beacon, swing your beam around to the location of the beam and monitor or call on the calling frequency.

If your radio has a scanning feature, you may wish to set it to scan the beacon band, perhaps with a hop to the calling frequency and monitor that, again with a light squelch if the white noise bothers you.

Call

If you don't hear anything on the calling frequency don't be shy about occasionally calling CQ. You may be surprised about who comes back. Like that tomcat in the old *QST* cartoon, you got to make calls to get results. Having said that, remember that the calling frequency is a shared resource so don't hog it. It is OK to call CQ on a dead band on the calling frequency but if you end up making more than a couple of contacts, or if you are going to ragchew, get off the calling frequency. But be sure to ask if anyone else is on before you go. There may be a weak station or two there that you missed.

Watch

The advent of widely available and relatively inexpensive panadapters or bandscopes, has made available to nearly every VHF operator the capability of monitoring a whole band segment at once. Some rigs, like the Icom 756 ProIIII (run it at 10 watts for QRP) have these built in, some, like the Elecraft P3 or LPan have them available as accessories, some like the Software Defined Radio (SDR) FlexRadios use an external computer to display the spectrum. The popular and inexpensive SoftRock SDRs are available in popular IF frequencies, so that is a way to get a homebrew panadapter.

Having a bandscope, one must decide which band segment to monitor. Depending on the processing capability, and the IF of the radio, this can vary from a few tens of kHz to a few hundred. The calling frequency is a good place to watch, as is the beacon band.

When coupled with CW skimmer software,

<www.dxatlas.com/CwSkimmer/>

which will decode CW automatically for up to 700 CW signals seen in the passband, the bandscope is a powerful band monitoring tool when set to the beacon bands as stations can be identified nearly instantly as to their location.

The Internet

The internet has revolutionized the way we look for band openings. DX Sherlock:

<http://www.vhfdx.info/spots/map.php?Frec=MUF>

has maps which show the sporadic E (Es) Maximum Usuable Frequency (MUF) anywhere int eh world, as well as QSOs that are being made at frequencies up to 432 MHz. It is a powerful tool and the first thing many VHFers check when turning on their computer. Many have it set as their home page. Of course, for this to be of any use, people must first make QSOs, so it still relies on someone to listen and make a QSO. So you still need to listen, no matter what DX Sherlock tells you.

Tropoducting is a fairly common mode of propagation related to atmospheric inversions in the parts of the US that have appreciable moisture in the air. Although a complicated chore, It can be predicted by using various reports that weather stations throughout the US and the World make. William Hepburn has developed an automated technique of determining when conditions will be good for tropo and provides these on the internet:

<http://www.dxinfocentre.com/tropo.html >

These predictions can be made several days in advance, so one can plan field outings, gridpeditions, and contests accordingly.

The widespread use of the Automatic Packet Reporting System (APRS), provides readily available data from which to extract propagation data. This data is available on the internet,

<aprs.mountainlake.k12.mn.us/>

and can be used to tell where two meter propagation is when you look at it. As it is largely an automated process from beginning to end, the data is usually reliablele unless someone has their APRS location wrong.

It is also easy to extract location information from PSK-31 signals and there is another website

<http://pskreporter.info/pskmap.html>

that does just that for a variety of bands. It is also available in versions for mobile devices; I use WaveGuide for the iPhone, which provides the same information, and much more, wherever I go that has cell or Wi-Fi coverage.

While these internet based tools are vary powerful, remember that most of them don't work if no one is on, so they don't replace listening and calling, only supplement them.

Weak Signal Activity Nights

Most areas have local VHF activity nights. While these may resemble nets, in most areas they concentrate on the weak signal aspects of VHF rather than the social, emergency preparations, or traffic handling aspects. The net control is usually well equipped. The group usually takes time to listen for weak signals, often boxing the compass during the hour to pick up weak stations. They are excellent for determining the capability of your station. If propagation is enhanced during an activity night, you will hear stations from further away than you usually do, and that is reason enough to search the bands for new signals. You may also try to contact activity groups in other areas near you.

Sporadic E

Sporadic E usually starts at a low frequency, intensifies, and moves up in frequency. So paying attention to what is happening during an Es opening is very important. As the opening intensifies, the MUF increases and the skip becomes shorter. So, if you are hearing QSOs between stations only a few hundred miles apart, or a few hundred miles apart, look for Es on the next higher band. In this fashion, monitoring 10M will tell you a bit about the propagation on six meters, and when the skip gets short on six, look to two. The openings on the higher bands often only last for minutes, so it is good to be vigilant and tune the band during openings.

During the peak summer months I usually take a scan or two of the lower FM band for Es on my way home from work. Without six meter capability in the car, this tells me whether or not six meters will be open when I get home. On a few occasions during each Es season, there are FM stations strong enough to override the local stations.

Aurora

If you live in the northern tier of states, propagation by way of aurora is a common way to work DX. To support aurora at the relatively low magnetic latitudes, the geomagnetic activity must be relatively high. That is bad for HF, but good for VHF. When the Kp index starts to climb above six to 10, depending on your magnetic latitude, point your beam north and listen to the characteristic buzz saw sound that accompanies signals heard by aurora.

Listen

Did I mention how important it is to listen?

Awards

Although not as popular as ARCI's classic 1000 miles per Watt award, ARCI does offer a QRP grid square award for working 100 grids. Endorsements in 100 increments are also available. While not specifically VHF oriented, it is certainly a worthy goal for the QRP VHF operator to strive for. So, gather up those QRP grid square contacts and apply for the award. If you have been involved in six meters for very long, chances are good that you have 100 grid squares already worked. W5JAY and I talked briefly of adding a VHF endorsement to this award at FDIM, so if you are interested in seeing that, drop Jay an e-mail.

VHF ARCI QRP Contest?

While at FDIM, Ken, W4DU, approached me and asked what I thought of ARCI conducting some sort of VHF contest, and if so, what form it should take. He has also talked to Jim, K9JWV, the ARCI contest manager about this. We both think it is a good idea.

So the question is, are you the VHF readers of *QQ* interested in such a contest, and if so what form should it take? In the past, ARCI has sponsored a "contest within a contest" in conjunction with the ARRL June VHF contests. We could do this again, or move it to coincide with the CQWW VHF contest, which, in addition to the Hilltopper QRP category, also has a fixed QRP category and may be more attractive to QRPers. We could also sponsor a separate contest, probably held sometime during the peak VHF season, probably June. With summer vacations, weddings, and vacations taking up a lot of people's time in June perhaps a contest that ran the whole month might be attractive. The pressure to take off an entire weekend would be relieved, and one could fold in contacts made during the June contest to the QRCI contest.

So let Jim and I know what you think of this idea. If you like the idea and have some suggestions for rules or scoring, keep them simple, let Jim or Jim know. ●●

Is it Time to Renew???

Your original QRP ARCI membership (and your member number) will last forever ... BUT, your continued subscription to *QRP Quarterly* means you are an active, dues-paying, voting member!

Renewal notices are included on your mailing label, and also sent by e-mail (if we have your address). You can also check your expiration date online at the club web site: www.qrparci.org — just click the "Member Lookup" button on the left side and enter your own callsign.

Send your renewal online using PayPal, or by check to the QRP ARCI Secretary using the form on page 56.

While you're at it ... check out the QRP ARCI Toy Store for QRP clothing and accessories, past FDIM Proceedings, and other items that show your enthusiasm for the QRP side of ham radio!

QRP ARCI — www.qrparci.org

Four Days in May (FDIM) Report

TimothyStabler, WB9NLZ wb9nlz@yahoo.com

As I stated in my editorial, this was my first time to attend not only FDIM, but also the Dayton Hamvention as well. And it was well worth it. If you did not attend, make some arrangements for next year (May 17-May 19). I am sure you will be very pleased that you came.I understand the Holiday Inn in Fairborn, where the meeting is held, is now taking reservations for next year's meeting. Chuck Stroud, KA8HDE, made some comments in the June Newsletter of the Minnesota Amateur Radio Technical Society that this was his first year for attending. He came to the meeting with his Dad, Jerry, AC8IB, who also was attending for the first time. He goes on to say it will not be 30 years before he returns. It won't be for me either.

I arrived Wednesday afternoon and got my room. Registration was held that evening as well as a general get-together. It was good to meet and talk with other attendees. When you registered, you got a printed copy of the *Conference Proceedings* and a ticket for the drawing Saturday night at the banquet. The proceedings are very good being a printed copy of the talks to be presented Thursday as well as any pictures or slides.

The next day, Thursday, following breakfast, the seminars began at 8:10 (Figure 1) in the ballroom with Craig Johnson, AAØZZ, (Figure 2) speaking on "Are QRPers Insane?" He said he wanted to fill in for "very" beginners and advanced engineers alike. He said he started off with a crystal oscillator but kept notes. He encourages everyone to keep notes on what they have done so they are aware of what works and what doesn't. There are programs like LT Spice out there for use. He then got into PIC microcontrollers. They all are good and use various computer languages. Craig has designed the PIC-EL board. A PIC-EL kit is available from www.amqrp.org. Craig felt Thomas Edison was an excellent CW operator and an excellent record keeper. He told everyone to do something that interests you, keep good notes and do not give up.

The next speaker was Scott Cowling, WA2DFI (Figure 3), who spoke on "SDR Progression: Softrock to OpenHPSDR Hermes and in Between". Important to SDR work is a reasonable sound card. He then discussed several available SDR radios including the Funcube Dongle (www.funcubedongle.com),the RTL-SDR Project, BeRadio SDR, and the Zephyr SDRstick (http://zephyrengineering.com/beradio; http://zephyrengineering.com/sdrstick). OpenHPSDR radio is high performance software defined radio (www.openhpsdr.org). Coming soon is the Hermes single-board DDC/DUC transceiver along with amplifiers and low pass filters. To me, this was a good talk on SDR radios.

Figure 1—Attendees listen to seminar presentations.

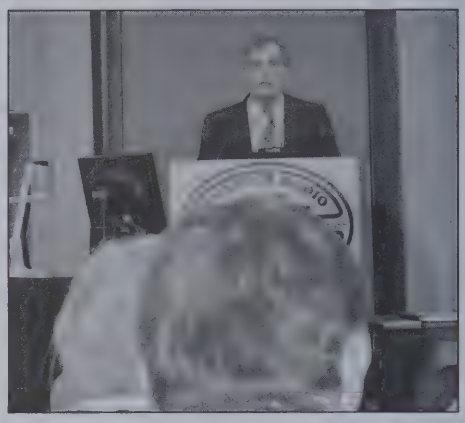


Figure 2—Craig Johnson, AAØZZ, speaking on "Are QRPers Insane."

The third speaker of the morning was James Duffy (Figure 4), KK6MC who spoke on "Getting Started in VHF and UHF weak Signal for the QRPer". VHF people collect grid squares. A grid square map is available from ARRL. QRZ has the grid square included in each listing. He then talked about E and F skip and that CW has a 15-18 dB advantage over SSB. E skip has a May to August "open" season and usually a short "open" season in December. He had brought two antennas that he has used for VHF work and showed them to the crowd. He mentioned two websites, www.wa5vjb.com and www.dk7zb.com that have antennas for this type work. The WA5VJB website has printed circuit board antennas while the DK7ZB website concentrates on Yagi antennas. James felt that one should start small with antennas as larger than 6 feet may cause problems. He said that beacons are good to learn about activity in the VHF ad UHF bands.

Following lunch, the afternoon started with "Hollow-state Homebrewing" by Grayson Evans, KJ7UM (Figure 5). This

Figure 3—Scott Cowling. WA2DFI, speaking on "Identity Crisis? DXer? Contester? QRPer?"

Figure 4—James Duffy, KK6MC, talking on "VHF and UHF Operating for the Beginning QRPer."

Figure 5—Grayson Evans, TA2ZGE/ KJ7UM, speaking on "Hollow-State (Thermatron) Homebrewing."

Figure 6—Jason Milldrum, NT7S, talking on "Leveraging Free and Open Source Tools in Homebrewing."

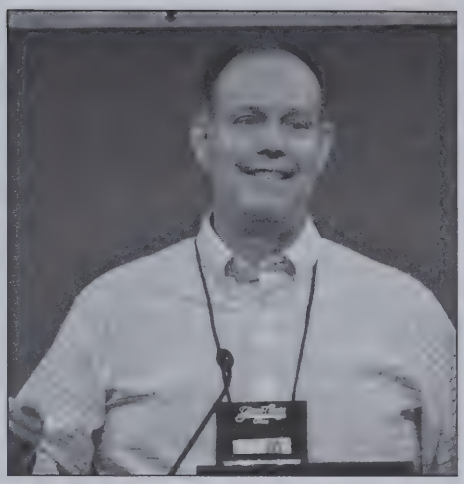


Figure 7—Edward Breneiser, WA3WSJ/pm, speaking on "Once You Go Pedestrian Mobile, You'll Never Go Back."

was a talk about vacuum tube radios. Grayson said they are electronically rugged, "smell good", form a new old niche, they look good and will outperform many solid state devices. This type of equipment is easier to build and work on. At the end of the 1960s, new tubes (Thermatrons) were being made that will outperform almost anything. Tubes are EMP proof and static discharge proof. Their characteristics are more consistant and linear than transistors. Homebrewing with tubes builds character. Many tubes (or thermatrons) are not that expensive but he felt you get what you pay for. They do not require high voltage power supplies, necessarily, as many were made for automobile use. Tubes, if operated properly should last at least 5000 hours. "Industrial" grade tubes can be expected to last 50,000 hours. Grayson then went through many popular tube types and their characteristics. He then got into home brewing techniques using thermatrons (tubes).

The next talk was "Leveraging Free and Open Source Tools in Homebrewing" by Jason Milldrum, NT7S (Figure 6). He felt most people were interested in homebrewing and said to take advantage of freely available tools. Computers, at one time, were very limited but today, that has really changed. One is now seeing a rise in open source software that can be used. He felt circuits should be created and modeled before building. Microcontrollers are a force multiplier and a cheap way to add functionality to a circuit. He then got into several of the microcontrollers now available and spoke of PC software development.His microcontroller of choicer is the 8-bit AVR from Atmel. One good reference is www.openqrp.org. Good documentation is very important, whether you are doing something for somebody else or even yourself. For this, one needs a good word processor. Microsoft Office is available. Another one is Libreoffice although it does not have all the features of Office but can export files to PDF, making it easier to distribute. Many circuitboards are found on www.dorkbodpdx.org and can be ordered. Jason has used Seeed Fusion at www.seeedstudio.com to make boards for him and been happy with the results.

The final talk of the day was "Once You Go Pedestrian Mobile, You'll Never Go Back" by Edward Breneiser, WA3WSJ/pm (Figure 7). I have known Ed since Atlanticon and it was good to see him again. In those days he was pushing walking the Appalachian Trail with his radio. Now he takes his radio everywhere he can walk. He likes the freedom to go anywhere. He says it is fun to learn pedestrian mobile and how to operate, it is fun building the HF pack you will be taking with you and it is fun to hear other people's excitement. One website to check out is www.hfpack.com. The parts are basically the mount, where everything goes, the transceiver, the power source and the antenna. In the Winter, lithium batteries will have problems. He likes the Buddistick antenna, a portable multi-band antenna (www.buddipole.com). He also likes the new nanoplate batteries as they do not heat up with use. The batteries, however, are expensive. One must remember the radio is still drawing power, even if not

Figure 8—Thursday vendor night at FDIM.

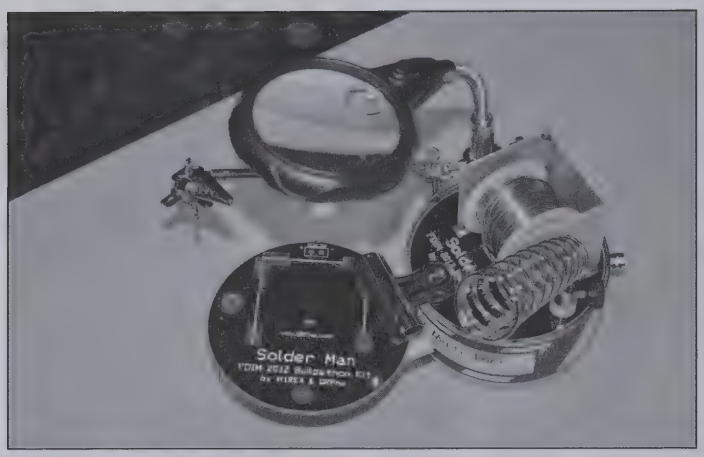


Figure 9—The Buildathon project included all these items; tools and project parts.

Figure 10—Rex Harper and his volunteers for the Buildathon.

transmitting. Ed feels it is fun to design your pedestrian station, to operate that station, to learn more about pedestrian mobile (pm) and fun to work others. Doing this type of operating does get you outdoors to enjoy the beauty of the outdoors.

Thursday evening was a vendor night (Figure 8). Several vendors showed up to exhibit their wares. It was also a time to get a first look at some of the homebrew stuff although voting was not done until Friday night. The evening also served as a meeting time for everybody to get a chance to talk to the seminar speakers and others who had attended the seminars.

Thursday night was also the time that Rex Harper, W1REX, ran the buildathon. His theme for this year was "Tools and Techniques". Each person got a kit of tools to build with including the Solderman third hand, and a lighted magnifier. They built a 6 watt dummy load and peak power probe on the underside of a circuit board and built a solder roll holder out of pcb stock on the other side.They then transferred the LED magnifier/third hand are and soldering iron holder from a stock unit. A pcb vice was made from a spring clip using more pcb stock material and superglue and mounted on that board. Final assembly yielded a 7 function multi-tool kit building accessory (Figure 9). Rex had a group of volunteers to help with the buildathon (Figure 10).

On Friday morning, the buses ran 7:30-9:00 AM taking people to the Hamvention. From 3:00-4:30, they brought people back to the hotel. Buses ran Friday and Saturday. I took the 7:30 AM bus Friday into the Hamvention, getting there a little after 8:00 AM. Since the doors did not open until 9:00, I took the opportunity to wander through the outside vendor area. People who have gone to Dayton know the vendor area is very large and one can easily spend a day there alone. I did find Fred and his Far Circuits tent. He told me that if anyone has a project they want to publish in this publication, he will do the circuit board for free. Around 9, I did enter the inside area and was really amazed how large the inside area was. I did see everything including The Morse Telegraph club (www.morsekob.org), who had made a presentation at Ozarkcon and The Radio JOVE Project (http://radiojove.gsfc.nasa.gov) and their radio telescopes. I have everything for a radiotelescope and just have to find the time to put it together. It was interesting to see the new Flex radio although their area was quite crowded. In retrospect, it was a good day and I was glad to get the bus back to the hotel. I admit I was tired.

Friday night was also a vendor night as well as the voting for the homebrew contest. There was a good crowd of people there and walking through the homebrew contest entries did take some time (Figure 11). Many people were stopping to talk with Brady Gordon, ACØXR (Figure 12), about his 6V6 transmitter from the February, 1964, issue of *Popular Electronics*. Brady is 12 years old and an extra class operator.

Saturday night was the banquet (Figure 13). Each person was given a ticket for the drawing to be held. I guess the earlier tick-

Figure 11—The voting table on Friday night at FDIM.

Figure 13—FDIM Saturday night banquet.

Figure 12—Brady Gordon, ACØXR, and his 6V6 Transmitter.

Figure 14—Stan Sindeev, UA3LMR, from Russia and Pietro Bengali, I2RTF, from Italy.

ets from registration were used to draw prizes prior to the banquet. Lists of the winners were passed out prior to the banquet so that one could get their prize from the front table. From the voting Friday night, the winners were announced. They included Richard Meiss, WB9LPU, for his key, David Cripe, NMØS, for his canteen receiver, Steven White for his LC test meter and Carl Herbert, AA2JZ, for his antenna. Best of show went to Richard Meiss, WB9LPU. Ken Evans, W4DU, president of QRP ARCI, announced that the latest people voted into the QRP Hall of Fame were Kevin Zietz, VK5AKZ, Jay Bromley, W5JAY, and Terry Fletcher, WAØITP. Congratulations to them all!!

At the end of the evening, Richard Meiss came to me and asked if he could send me a letter with some comments from him. He had not spoken when he received his awards and others had. Here are his comments.

"When I retired from a career in biomedical research, I left some important things behind, as many retirees soon discover. In my case, one was an outlet for my (almost compulsive) building of electromechanical instrumentation, and another was the peer group who understood and appreciated what I was doing. I am happy to say that my association with QRP ARCI and its emphasis on homebrewing of radio equipment has gone a long way towards replacing both of these missing parts. Every year I look forward to FDIM, when I can meet and chat with friendly and knowledgeable hams and participate in the Homebrew Contest and the Show and Tell sessions. Many thanks to the leadership and the many volunteers for providing these opportunities, and to my fellow QRPers who have appreciated my work.

—72/73 de Richard Meiss, WB9LPU"

When I was leaving Sunday morning, I ran into Pietro Bengali, I2RTF, and Viacheslav (Stan) Sindeev, UA3LMR, two of the FDIM attendees from outside the U.S. I had met and talked with (Figure 14). FDIM was really a very good meeting for everyone and I hope to meet you there next year.

●●

FDIM 2013 will be held at the same hotel (Holiday Inn, Fairborn, OH), May 17-19, 2013

Room Reservations for FDIM 2013 are Available NOW!

The dates for FDIM 2013 are Thursday, May 16, 2013 through Sunday, May 19, 2013, and the hotel reservation process begins immediately. The rate for 2013 will be $111.00 per night plus 12.5% tax and includes a free breakfast buffet.

The process will be different from previous years in that the club will not be taking the reservations. The Holiday Inn Fairborn will be the contact and take all reservations. You *must* call the Holiday Inn Fairborn at 937-431-4613 to make your reservations. It will be staffed Monday thru Friday from 8:00 AM to 5:00 PM. If you call after hours, leave a voice mail and your call will be returned. You must tell them you are with "FDIM" to receive the $111.00 per night rate. Do *not* call the Holiday Inn toll free number.

de W4DU, QRP ARCI President

PC Board Construction 101: Part 2

Chuck Adams, K7QO chuck.adams.k7qo@gmail.com

In a recent issue of *QRP Quarterly*, (Winter 2012) I wrote an article showing how to use the Toner Transfer Method to construct printed circuit boards for various projects. Since that time I have discovered several things that I think are important enough to write this second installment.

If you study the modern laser printer technology, you will find that the technology allows one to electrostatically transfer the toner to the paper, and as it passed through the internal mechanism the toner is heated to a high temperature to melt the plastic component in the toner. When it cools, the toner material stays on the paper to become the text or image that you see.

Different printers, as it turns out, have the melting point of the toner at various temperatures. The ironing transfer method, when used at the highest temperature setting of the clothes iron, will melt the toner back off the paper and onto the PCB material. A number of people have discovered that the HP laser printers seemed to work the best. I have found that the HP toner has such a high melting point that ironing is about the only way to do the transfer.

Fry's Electronics here in Phoenix had a Samsung Printer on sale for forty-nine bucks and I bought one to experiment with. Such a deal. When using the iron I was surprised that the paper shifted more easily and thus smearing the toner on the board, thus resulting in a mess. One of the nice things about the technique of toner transfer method is that with fine steel wool you can go and remove the toner and try again. The only thing that you have lost is some toner in the error made. What is happening is that the Samsung toner has a much less melting temperature than the HP toner. So back to the drawing board.

Previously, I had tried using a platic badge laminator to transfer the HP toner off the paper and onto a PCB and did not have any luck with it. The Samsung problem with ironing got me to thinking that maybe, just maybe, I should go back and try the laminator again.

Here is what I have found. The laminator technique works great with the Samsung printouts. I use a GBC brand "Badge Mates" model H45 that uses 120 W. I have included a photo of the item.

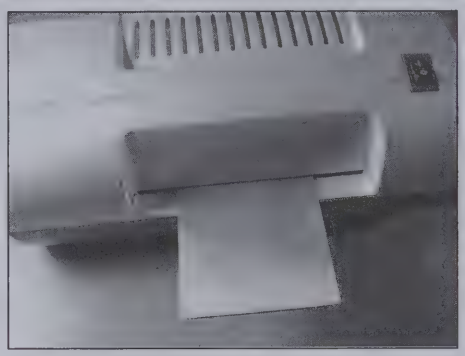


Figure 1—GBC laminator preheating the PCB.

Figure 2—Harbor Freight plastic clamp to hold heated PCB.

Figure 3—The PCB for Microchip project.

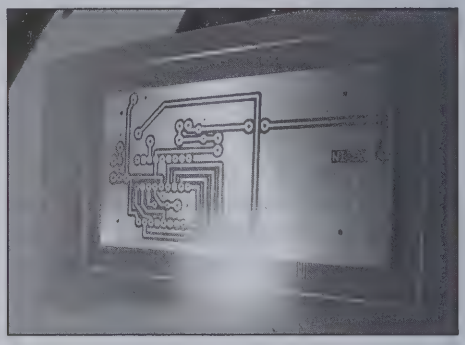


Figure 4—K7QO frequency counter PCB.

It will only do boards that are 5.25 inches wide or about 11 cm. I doubt seriously that you would do a single sided board much wider. You can have just about any length you want, but you will have to worry about the thermal mass causes the laminator to cool down during the heating of a long board.

What ever type of laminator you buy, make sure it has a straight through laminating path and not bent or curved. It is hard to bend 0.060 in thick PCB material. I find that the GBC can handle the 0.060 thick material. I have purchased a larger GBC laminator at Office Max to experiment with, but have not gotten around to it just yet. That will be in Part 3. Be sure to renew your subscription to find out what happens.

Hinks & Kinks

Now for some hints and kinks. I used an IR thermometer from Harbor Freight to do some measurements. I find that running the board through the laminator two times before placing the PCB layout paper on the board works great to get the toner to stick on the first pass. If you do not do this, then the paper will slip and not stick at all or stick in the wrong position.

With two passes I measure a temperature of about 95 degrees F. I then find that eight more passes through the laminator gives me an exit temperature of over 200 degrees on the Fahrenheit scale or 100 degrees on the Celcius scale. Now this is a very hot temperature and you do not want to be grabbing the board with your bare hands. I found that I could not find a pair of gloves that worked well for me handling small boards.

I found a simple solution. I use a plastic clamp to grab the board gently when it comes out of the laminator and use it to reinsert the board back into the laminator. A photo also included. These are those small plastic clamps you usually see on the racks at the checkout register at Harbor Freight. Just a few bucks for six or eight of them on a card. Well worth the savings on

wear and tear on your hands. A the little critters come in handy, at least for me, in hold items to tin or to hold small things together when using epoxy. I'm sure you'll find a few more uses for them.

I have now done a number of boards for Microchip computer projects requiring narrow traces and finer detail that I normally need for QRP projects. I have yet to screw up a board project using the laminator with the Samsung printer. My only problem is going to be when I go back to Fry's Electronics for a new toner cartridge. I guarantee you that the price is going to be more than the $50 I paid for the printer on sale. LOL.

Here is hoping that this information will get you to try some new stuff. I know that I am hooked on the technique. See you down the old logbook.

—de K7QO

●●

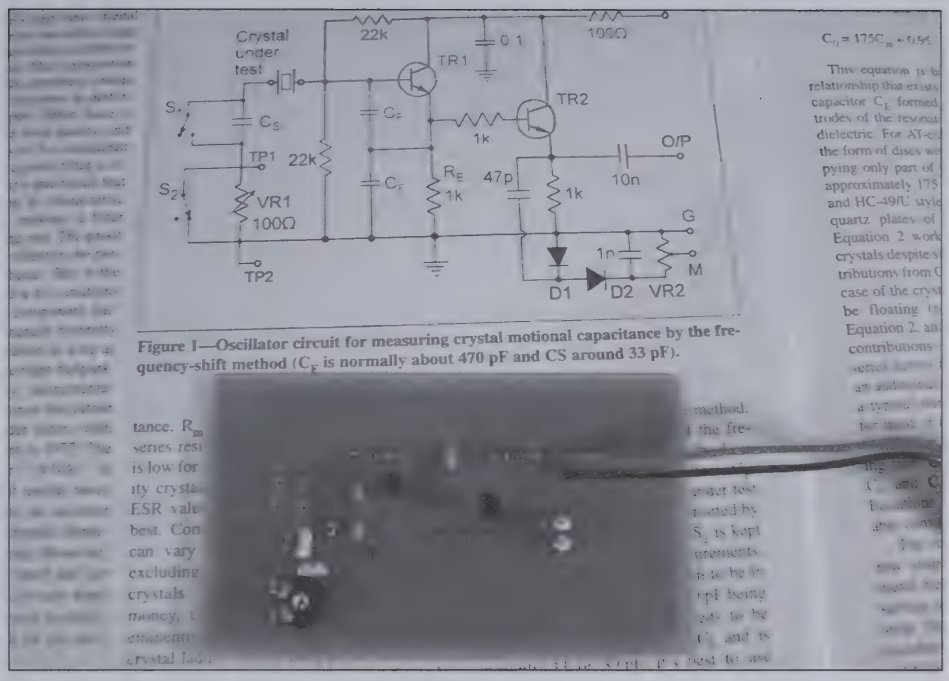


Figure 1—Oscillator circuit for measuring crystal motional capacitance by the frequency-shift method (C_F is normally about 470 pF and CS around 33 pF).

Figure 5—G3UUR crystal oscillator PCB project from *QQ*, Winter 2012.

QRP-TECH Project Number 001

Chuck Adams, K7QO chuck.adams.k7qo@gmail.com

As moderator of the qrp-tech group, I felt it is a part of my duties to create some interest in building something on workbenches around the world. This is not as easy as it looks as there are so many areas of interest that do not overlap for every one.

But, luckily there is the workbench itself. You can never ever have enough test equipment. Some will say it becomes a problem, that with too much equipment you become like the man with two watches. He never knows what time it is.

With multiple options for the same test equipment it becomes more interesting to do experiments and compare notes. So I started with a series of projects that I call the "QRP-TECH Sandbox" and project number 001 was something that Wes Hayward, W7ZOI, had on his web page:

<http://www.w7zoi.net/>

Look under the topic of test gear and you will find his version of the popular RF signal generator made by HP at one time, model number HP-8640B. This generator is no longer available except through surplus channels or if you are lucky enough to find one at a swapmeet or one of the popular online swapmeet type sites.

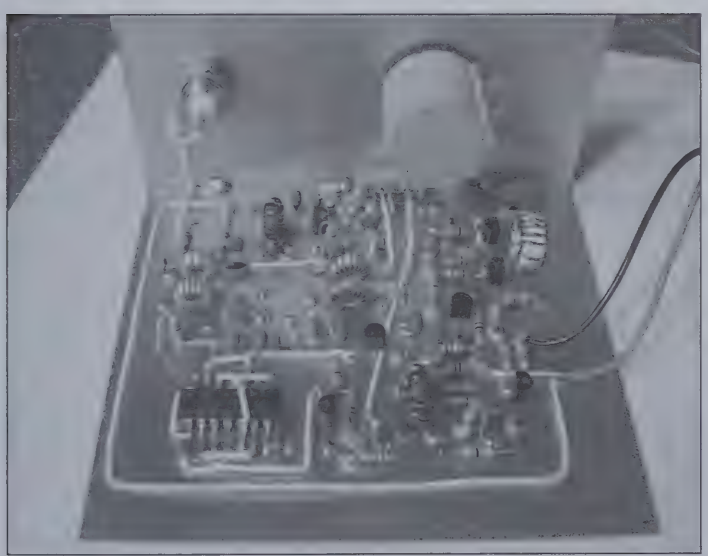


Figure 1—View of signal generator from the back.

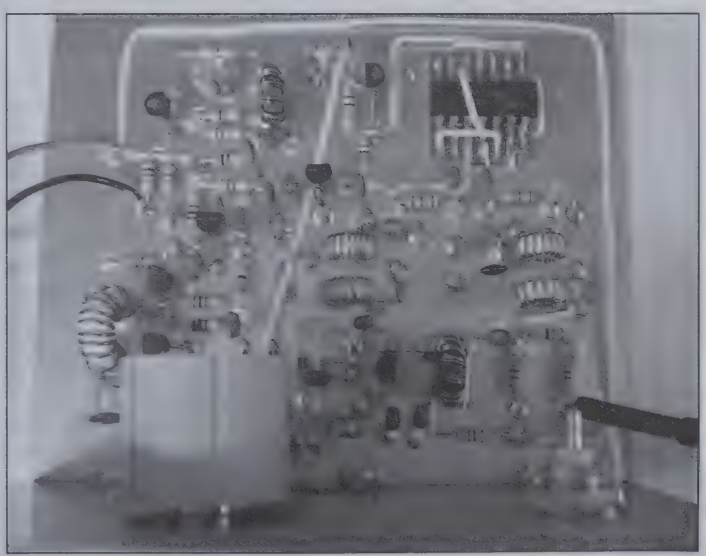


Figure 2—View of signal generator from the top.

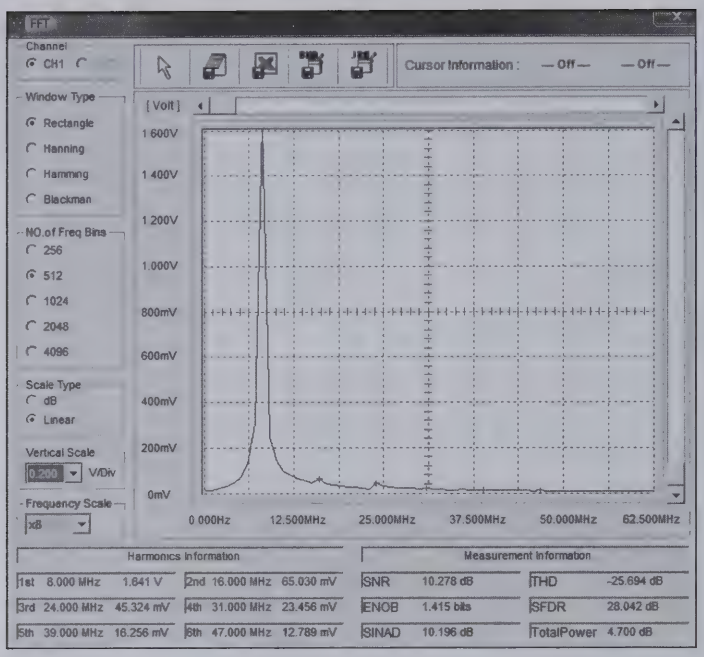


Figure 3—Spectral display of 8.00 MHz output from the generator.

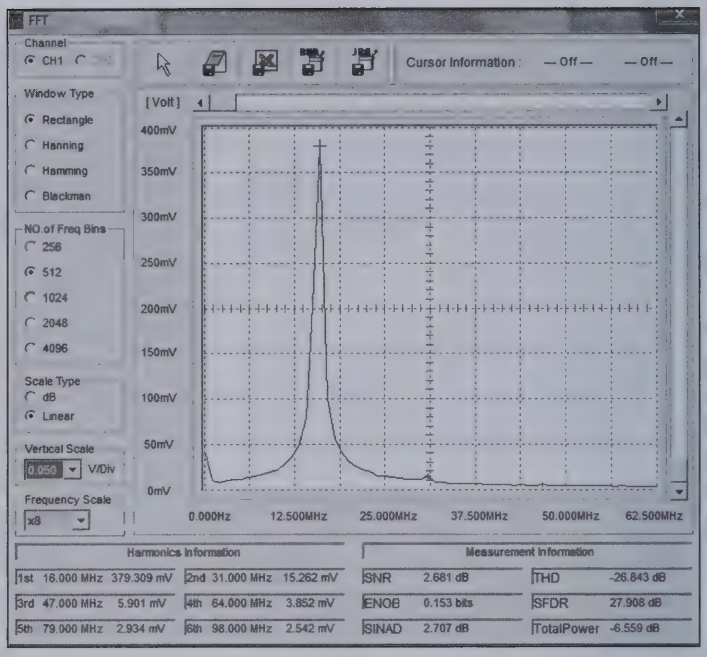


Figure 4—Spectral display of 16.00 MHz output from the generator.

Wes called his version the 8640-Jr. The signal generator output a +7 dBm signal from approximately 3.4 MHz to 32 MHz in three ranges. The local oscillator has a range of 13.6 MHz to 32 MHz and that becomes one range and the other two ranges are produced by using a divide by 2 and divide-by-4 circuit using a 74HC74 integrated circuit. Wes has a PDF document at his site that explains all this in detail along with the schematic.

Doug Hendricks, KI6DS, being the kit manufacturer that he is, came up with a $25 set of parts for those interested and 100 people signed on to the project. We started this in April of 2012. Some finished within the first day of the arrival of the parts and some of us took longer. And then there are those that will hold on to the parts for a long time and may get around to building the 8640jr project.

Each individual got to choose their own method of building the signal generator. Some went ugly style, some went Manhattan style and some created circuit boards. I chose to do this one Manhattan style. The famous Paul Harden, NA5N, did his usual fantastic artwork for the layout using the Manhattan construction technique. It was a fantastic job and he spent considerable time in doing it and it is appreciated by all. In fact, it was part of the learning process for new builders. There were several modifications made during the time period early on in the project and Paul did a rapid turn around on the artwork. You can view this online in the qrp-tech yahoogroups.com file section. This may require you to join the group.

As it is with any homebrew project, there is the issue of parts. Wes used an air variable and Doug supplied polyvaricon caps with the parts. I bought one of the parts sets but chose to use a varicap in place of either. It worked out just fine.

Here are some photographs of my build for the project. I have asked members of the group to send in their photos to Tim for this issue and we just have to see how that worked out. Lots of hams are shy. This was not a contest and it isn't a beauty pagent.

There are multiple reasons for my writing this article. Many exciting and interesting projects exist that should get you interested in building in the upcoming winter months. I know it looks like there is plenty of time before winter gets here, but there is not as much time as you think. You don't just sit down and do one of these projects.

You have to do some research. Find a project that interests you and in an area of study in which to develop your skills. Search through your library of ham radio or electrical engineering books. ARRL is noted for lots of publications and there are back issues of *QQ* also and then the largest playground on the planet is the Internet. All you have to do is google for something and most certainly some one has a web page devoted to the topic. Some of it good and some of it bad. That is why you have to do your homework.

Then you have the lovely job of hunting down the parts. Few of us have a parts supply in house that has every item we need. Then it's off to find the missing parts and this is why you need to start early.

If you look at all the workbenches of experimenters, you will see that they have two things in common. Lots of test equipment and lots of parts. Now is the time for you to start your climb to the top of the food chain. There has just got to be some piece of test equipment or gear that you want to build.

Here is hoping that I see you write up your project for *QQ*. If we, as radio amateurs, QRPers and experimenters do not do the work and write it up and publish here then the hobby is in serious trouble. It is the continuing effort of more than a few individuals that is required to bring life back into my favorite part of the hobby and that is building and sharing. Life is too short not to build. Humbly submitted. Don't make me write another article.

—LOL and 73, Chuck Adams, K7QO

Oh... Project 001.5 was the G3UUR crystal oscillator that appeared in the Winter 2012 issue of *QQ*, and whose pc board is shown in the previous article. ●●

Ten Steps for Successful QRP Portable Operation

Brian Murrey—KB9BVN kb9bvn@gmail.com

Here are my Top Ten Steps for successful portable QRP operation. I hope you find them as useful as I have!

1. Propagation and Band Activity.

When you operate QRP portable you want to work as many people as possible so the band conditions must be good. This means that you have to keep track of the propagation conditions before planning an operation. I try to look for propagation predictions for the band i plan to operate on but they are not very reliable. I check the QSL Net propagation site at http://dx.qsl.net/propagation/. The flux has been up up recently but we still see seasonal variations. 10 meters was great in the fall but now in the winter it is pretty bad. There is still E-skip possible. This is always changing, 15 meters and 17 meters can be the best if 10 meters is dead.

Before I pick a date to operate, I monitor the bands at the same time that I plan to operate. The Absorption Index is also a key factor, I never operate when the A Index is above 6. I also use the NCDXF beacons (see: http://www.ncdxf.org/beacon/beaconschedule.html), Trenton Military (15,034 kHz) or CHU (14,670 kHz) for 20 meter propagation checks. You might also use WWV/WWVH. 20 meters is best for day time country wide propagation. 40 and 80 meters are good for night time operation. I always try to avoid contests and other busy periods. Checking the *QST* Contest Calendar helps to insure the band is going to be clear. Check your desired frequency in advance, you don't want to pick a frequency that is used for nets, traffic handling or RTTY.

2. Weather Conditions.

The weather forecasting is really good, so this is easy. Try http://www.wunderground.com/. I look for warm temperatures and no wind. Check your local web cam (state or municipality Dept. of Transportation). Even Pikes Peak has a weather station and Panoramic HD web cam (see http://www.springsgov.com/units/pikespeak/ index.asp)

3. Honey Doo Items.

Always check the XYL's honey doo list and make sure you are clear for the day. This will insure that you don't become a divorced hermit.

4. Location and Road Conditions.

Try your local National Park (http://www.nps.gov/findapark/index.htm). If you are an Old Timer you can get a lifetime Pass. Always check the road and site conditions before going out in the field. You don't want to drive hundreds of miles to find out that the Capulin Volcano road is closed by snow. Canyon roads can have snow or landslides, Even Pikes Peak can be closed or have a delayed opening and prevent you from getting to your desired operating location on time. Pick an open space operating site, canyons are not good for QRP operating. You might need trees for hanging an antenna or if you are going to operate Pedestrian Mobile with a whip you will want to find trails that don't have a lot of overhanging, antenna eating braches.

5. Equipment Readiness.

You need to check out your equipment right before you head out to your operating site. This prevents leaving behind some critical item. Needless to say, you should have your antenna all pre-tuned before you leave. My radio is always mounted to a backpack and is always ready to go. The LiIon battery is always charged but i always take a spare. I just need to put the back pack into the car, with the antenna and counterpoise. The accessories are also checked: microphone, earphones, key, SWR meter, pen, log, watch, hat, gloves, coat, etc. Make an equipment checklist. It is good to have a spare accessory batteries, a spare radio and duct tape for contingencies.

6. Vittles.

I take water, lunch and my VHF HT in a fanny pack.

7. Operating Announcements:

I try to post my operations on the reflectors a day before the operation. When you post too far in advance, people forget and when you post right before the operation, some people don't get the notice until after you are finished. I always try to be on my exact posted frequency (or alternate) at the exact time so people don't get stood up. Posting your operating times gives you more Qs. It is no fun running your battery down calling "CQ" with no responses. QRPspots, HFnow, GORC, QRP-L, SOTA Summits are good places to list your operation, as appropriate. Post your schedule in GMT (Universal Time/Zulu time) as well as your local time. Also post details about your operating location, links to pictures, trail maps, QSL Information, will be helpful, etc.

8. Prep Your Vehicle.

Fill your gas tank! [*Do this the day before... and check the tires, too! — ed.*.]

9. Initial set up.

When I arrive at my operating site, I set up my rig, attach the antenna, and check power and my operating frequency. When operating Pedestrian Mobile, I tune my whip and dragwire, put on my backpack and I am ready for the trail.

10. Safety.

Always be prepared for adverse conditions. You might need rain gear, snake proof boots, First Aid kit, etc. Always give someone your travel plans. Take your cell phone or an HT that will hit a repeater.

For more detailed information get: WA3WSJ's new book *Amateur Radio and the Great Outdoors* or his *Amateur Radio Pedestrian Mobile Radio Handbook*. See http://www.lulu.com/product/paperback/amateur-radio-pedestrian-mobile-handbook/16364181. There is also a PDF version available.

That's it, the Top Ten Steps for QRP portable operating. If you are addicted to QRP, you can consider this your 12 Step Program. Feel free to add your own last 2 steps.

—72/73, KB9BVN

●●

New Discovery of America for FDIM 2012

Stan Sindeev—W8/UA3LMR ua3lmr@mail.ru

The dream to visit the international meeting of QRP ARCI in Dayton appeared to be very distant back in 2006 when I met with guests of honor—the then president of QRP ARCI Dick Pascoe, G—BPS and the president of Hawaii QRP Club Dean Manley, KH6B. Since 2007, I began preparations to realize this dream. It would take too long to describe what difficulties have to be overcome for the sake of it, all HAM radio living in Russia and CIS countries already know about them first hand.

All bad things come to an end sooner or later and here, at the beginning of this year, it became finally clear: a trip to FDIM 2012 was to be! Personal correspondence with the present president of QRP ARCI Ken Evans, W4DU, obtaining the official invitation and the American visa became the last stroke.

On May 15 I started from Sheremetevo Airport, Moscow to Amsterdam with a change of plane to Detroit and a further change to Dayton. The time of flight (with connections)—18 hours in total. Under the plane wing—Canada (Fig. 1), so 8000 km are overcome, only 3100 km remaining.

The last breakthrough by taxi from Dayton Airport to Fairborn, Ohio and here a final point—the Holiday Inn hotel reserved by QRP ARCI for carrying out the meeting (Fig. 2). Hi, America, my journey here was long.

The first difficulty which I faced was insufficient knowledge of the language. My practice consisted only in carrying out radio communications and reading technical literature. But America is not for nothing the country of immigrants—on reception in the hotel, in cafes and at communication with American HAM radios it became a big help. If I didn't understand something, people tried to explain in various ways what exactly I needed to hear. Of course there was everything, including gestures by hands.

American Express traveler's checks became the second problem for me. On their website and those of many other banks I read that by means of traveler's checks it is elementary to pay for any goods and services in any country of the world. Don't trust them—they are lying! It became clear that these checks in America are not accepted practically anywhere! It was a blow, after all I brought the main part of money in American Express traveler's checks. But it was possible to eliminate trouble by means of my new friends: Tom Rousseau, K7PJT and Dee Lynch, K7JRB from Oregon.

Figure 1—Flying over Canada.

I got acquainted with these cool American guys very simply: after placement in hotel I went out of doors to smoke and faced them face to face. As soon as

Figure 2—The Holiday Inn Fairborn.

Tom and Dee had checked in, they came for me, and we were joined up with an amicable crowd in a bar at the hotel to drink … isn't present, not some vodka or whisky, and it is simple beer and to chat "for life." In the course of conversation I told them of my problems and as the next day was free, they decided to help me. It became clear that Tom on arrival in Dayton had rented a car, and they were going to visit a shop selling old and military radios in the small town of Lima. They also planned to see the museum of military aircraft and astronautics. After long clarification of my plans for the morning, they kindly offered to me to keep them the company in this voyage and I naturally agreed. So, next morning, after a joint breakfast, we went to the city of Lima to rummage in old American equipment (Fig. 3). The request not to confuse to the capital of Peru, in America there are a lot of the cities duplicating names of the capitals. For example, on the way to Lima we passed Sydney.

Figure 3a—Shop of old equipment, Lima, Ohio (at the left Tom, on the right Dee).

Figure 3b—Multi-meters of racks with radio components and old radio meet visitors.

Figure 4—Air Force Museum.

Figure 5—Nuclear bomb used at bombing of Nagasaki in 1945.

Figure 6—The Lunar Landing Module.

Yes, here it is possible to wander for HOURS! The long hangar with a heap of racks filled by radio components, old and military radio engineering, devices, tools, aerials and every possible radio amateur (and other) literature. We passed nearly three hours there!

Then we began further attempts to cash my traveler's checks. In spite of the fact that I had three plastic cards, without cash in America there is nothing: here it is accepted to tip to all—from the taxi driver and the waiter to the cleaner in hotel. We went round three banks and everywhere met polite refusal: "Sorry, the sir, we don't work with traveler's checks." In the third bank they suggested to us that we visit Chase Bank—one of the largest banks of the USA and there I was met with happiness. I at last cashed my checks. Hurrah, now I can feel free!

I invited the guys to have a bite in a cafe at my expense to thank them for their help. Feeding in The States to me, to be honest, wasn't pleasant—continuous fast food. I dreamed of a borsch, Russian cabbage soup and a thick piece of house fat with garlic, and also a wine-glass of the misted-over vodka under a salty cucumber.

Figure 7—Monument to the pilots who were lost in all wars.

After a lunch the road brought us into a museum of the U.S. Air Force (Figs. 5, 6, 7). The museum consists of six hangars, in which the real planes and rockets are placed (naturally all fighting weapons are put out of action) and park with monuments. We visited only a few expositions—I was a little tired for this day. Looked at exhibitions of planes of times of the Second World War (the Soviet fighters and bombers in an exposition aren't present, there are only American, German and Japanese planes), cold war and a military space exposition.

As I am a former private soldier of Rocket Strategic Forces, to me it was interesting to look exactly at the last exposition among which exhibits strategic rockets of those times when I served in army are placed.

After the museum visit, we were all tired, but happy with our trip and returned to hotel.

And there first signs (apart from Tom and Dee) that FDIM-2012 was close. Directly before hotel on the parking lot were tens cars with aerials. I recognized everyone as a radio fan and there were numbers from many states—their personal call signs are used for their car registration plate (Fig. 8).

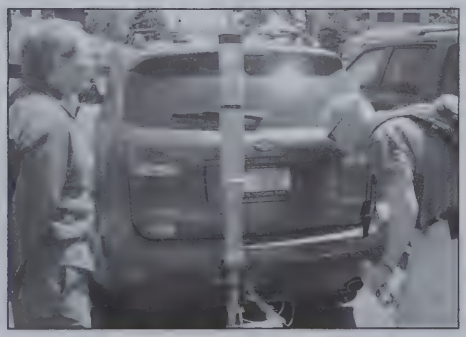


Figure 8—Arriving at FDIM.

In the hotel, near to the Ballroom in which seminars next day were planned, at full speed there was a registration of participants of a meeting with delivery of personal badges, programs of FDIM proceedings and the magazine with the short description of the forthcoming seminars. The vice-president of QRP ARCI Kathy Bromley, WQ5T—the woman, the beauty and simply cool HAM radio was there (Fig. 9)!

Having registered, Kathy took me by the hand and, having arrived in the hall, tried to draw the general attention … by whistling. After the failure which has comprehended it, I remember rowdy-dowdy youth and, at last, there turn on us looks of nearly fifty people, with surprise looking at us. Having heard from Kathy message that they have on a visit a QRPer from Russia,

Figure 9—WQ5T's friendly greeting.

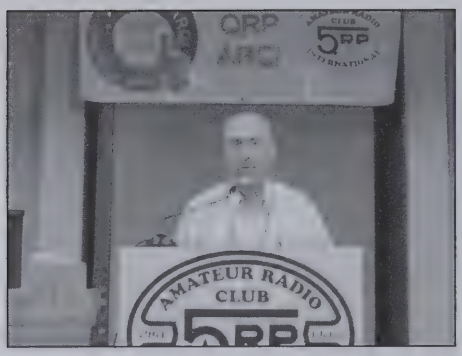


Figure 10—Ken Evans (W4DU), the President.

Figure 11a—Buildathon.

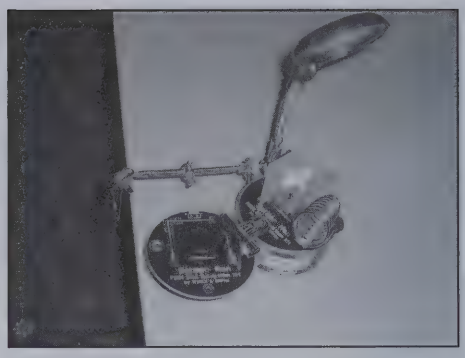


Figure 11b—And more Buildathon.

all crowd amicably cried out something like: "Hi, Stan! Welcome!" Well, and further, everyone considered a duty to approach, greet and a little to try got in tenacious American paws almost live DXer!

After a couple of hours of DXers, at last I could escape from these friendly embraces and went to sleep—the day was outstanding and very full.

All night long and next morning the parking filled with new cars with aerials and when I left after breakfast, an empty space almost didn't remain. Only officially on FDIM there arrived over 120 people almost from all states and Canada. And after all there were also those someone till last day didn't know about a trip and was registered among participants already in hotel!

This day was entirely devoted to lectures on various radio amateur subjects. Everything began well as is necessary, with a salutatory word of President Ken Evans, W4DU (Fig. 10).

Further were heard:

1. Craig Johnson, AAØZZ with a question: "Are QRPers Insane?"

2. Scotty Cowling, WA2DFI with the following questions: "Identity Crisis? DX'er? Contester? QRPer?"

3. James R. Duffey, KK6MC told about: "VHF and UHF Operating for the Beginning QRPer."

4. Grayson Evans, TA2ZGE (it is KJ7UM) with the cool lecture "Hollow-State (Thermatron) Homebrewing."

5. Jason Milldrum, NT7S told to respectful public about "Leveraging Free and Open Source Tools in Homebrewing," and in end,

6. Edward Breneiser, WA3WSJ/pm with the story which at once has intrigued me that led to acquisition of its book (naturally, with the donative signature of the author!): "Once You Go Pedestrian Mobile. You'll Never Go Back!"

These lectures were perfectly prepared and issued. Despite mine not absolutely full knowledge of language, I listened to them with a great interest.

And after a dinner, in other hall Rex, W1REX which our many readers know as the founder and the owner of QRP Me, carried out well-known Buildathon (Fig. 11) on which all wishing could try their luck in QRP Lil Squall Transceiver II transceiver manufacturing. The designer, the equipment enters into cost of the ticket for its soldering, the help of knowing people and a pizza. Even in case you won't take a prize, the ready transceiver on the basis of this designer becomes your consolation prize. It looked so:

Late in a hall where passed seminars, Night of Vendors began. QRP clubs, representatives of Ten Tec and certain radio amateurs were vendors. Traded in everything: from books and badges to transceivers and aerials. Oh, if not problems with our customs and limited quantity of means which were allocated by my wife for this trip! Probably, she knew that I can't keep at the sight of all this wealth!

So one more my day ended, and for tomorrow all was waited by radio amateur Mecca under the speaking name Hamvention 2012 …

"Morning paints with gentle color of a wall of the ancient Kremlin" (words of Russian song). Morning stood out real, American—temperature behind a board near +26°C here and was started singing. Near the hotel we were waited on by a miracle of the American automotive industry—school buses, for transportation of participants of FDIM to the Hamvention.

We are loaded and come to the city Dayton, in a place with the speaking name Hara Arena. We buy entrance tickets for $25 for three days, we do not forget to tear

Figure 12—School bus to Hara Arena.

Figures 13a & 13b—The Hamvention flea market and exhibtion.

Figure 14—Bob Heil, K9EID.

Figure 15—Here is this beauty, a new Kenwood TS-990!!!

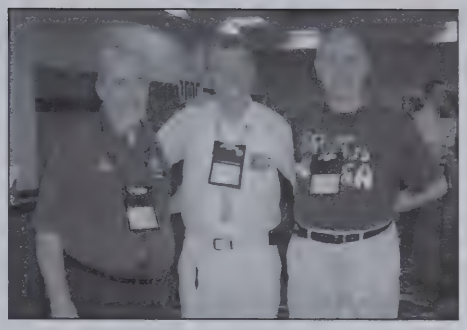


Figure 17—Ready for the banquet, with W4DU and KD8FCB.

Figure 16a & 16b—QRP booths in Hara Arena at the Hamvention.

off the coupon from the ticket and to throw it in a special ballot box (the lottery is included in cost of the ticket, it is possible to win everything: one Kenwood TS-590. About 10 lottery pieces were played!) and here we inside.

Oh, yes! Imagine very big arena, build on the second floor and all this divided into small halls, in each of which about one hundred firms trading in our gadgets. Plus to it round all arena at distance about 150 meters of tents trading in the same ham gear, but only second-hand. Here it also is "Hamvention"! A sea of people, all with "talkers" [HTs —ed.], call signs and badges! Hi, radio amateur paradise (Fig. 13)!

From everywhere "dee-dah" sounds, QSO scraps, discussion of lectures which are read in four next halls by great hams—the contestmans, known DX mens and builders, and there, look, the well-known Mr. Heil (Fig. 14) went simply on foot! Well, precisely, here its stand, it is possible to listen to his lecture about microphones:

With so many people, it was hard to break through the crowd. It is necessary to do the maximum zoom, and hands that shiver, whether from excitement, whether … (Guys, I said yesterday that the last glass of beer the superfluous!). But the photo is made, lecture is heard, a storm of applause awarded Mr. Heil. We make the way further—I somewhere nearby saw the stand of Kenwood (Fig. 15)!

A little farther, the Yaesu stand and in it the FT-9000. The group of men tries to be photographed with it in an embrace, is visible on personal QSL. On a breast badges: NC2Y, VE3VDX. The photographer - woman orders: "Vasya, well you as not live, Lyosha, smile!" Good gracious! Russian!!! Guys notice me: "Fellow countryman!!! Hi!!! How there RUSSIA????!!!!" "Boys, and didn't see Ed, NT2X?" "Yes here he just departed! On phone, call!" Oh, now, didn't find each other in this ant hill!

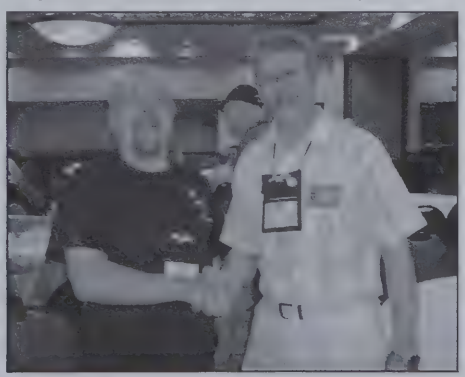
I wander on the arena some hours (Fig. 16). In passing, I collect everything that is possible. It will be useful as memorable prizes to clubmates! I find the stand of my club, RUQRP. It would look not worse! Perhaps next year we will try?

In the evening a farewell banquet, rewarding of winners of Buildathon, draw of prizes and a photo for memory (Figs. 17-20):

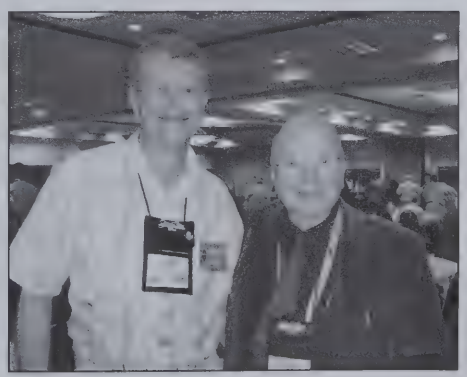
Here my holiday also ended. I left with tears in the face, but with big pleasure—after all I found in soul here many new friends! These remarkable people gave to me strong support and I never will forget them! Guys, I love you!

●●

Figures 18—With Kathy, WQ5T.



Figures 19—A laugh with Ed, W1RFI.



Figures 20—With Pietro, I2RTF.

Three Wheels and Five Watts

Rem O'Donnelley—K6BBQ marinqrp@gmail.com

I enjoy operating QRP, especially portable and even more when operating tricycle mobile (Figure 01). The majority of my outdoor operating is portable where I ride my TerraTrike recumbent tricycle to a location, set up my Buddipole or an end fed half wave antenna, set a table up next to the tricycle and make QSOs. However, some of my outdoor operating is tricycle mobile where my station is totally self-contained.

I first started doing tricycle mobile back in 2004. My station was very different back then. I used a two-seat kids trailer that had a sheet of plywood, which was held onto the floor of the trailer with several velcro straps. On that board I had a mobile mount holding an Icom 706KMIIG and a 100 Ah deep cycle marine battery. The trailer had an MP-1 SuperAntenna mounted on it. On the trike was the control head of the 706 which was on a RAM Mount gooseneck and base. The base was mounted on the left outrigger close to the left tire and secured with an automotive hose clamp (Figure 02). This was a good start for being tricycle mobile but the 706 consumed a lot of power in a short time and the trailer was cumbersome to maneuver.

Figure 1—Rem, K6BBQ operating ham radio on his recumbent tricycle.

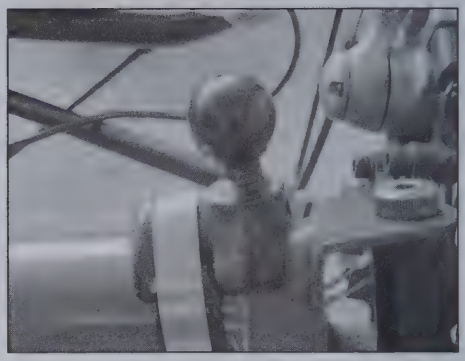


Figure 2—RAM Mount base secured onto trike with an automotive hose clamp.

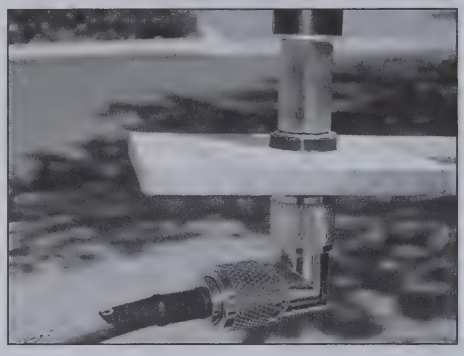


Figure 3—A close-up of the antenna mount on trike.

Figure 4—Ground braid connected to the side of the FT-857.

I later switched from the 706 to a less power hungry Yaesu FT-857D. Since the 857 consumed less power I was able to eliminate the trailer. I put the body of the 857 in a pannier bag (designed to hold paper grocery bags) on the bike cargo rack. I drilled some holes for bolts in the cargo rack and a 2' x 4" piece of aluminum. At the other end from the rack I mounted the MP-1 antenna (Figure 03). The control head of the 857 is mounted on the same gooseneck that I had the 706's control head on. I switched to a much lighter 7.5 Ah gel cell for power but I still had a dragging counterpoise.

Using a dragging counterpoise is widely done by pedestrian and bicycle mobile hams. Having a wire counterpoise dragging behind the trike got old quick as I kept having people with good intentions telling me I was dragging something.

Multiple times each outing drivers and pedestrians alerted me about the dragging wire. Occasionally the wire would get caught under a car's wheel or person's foot and disconnected from my station. Somewhere I had read about a ham who grounded his radio to his bike frame which freed him of dragging a wire. This made me curious if I could do this. My trike's frame is made of Chromoly steel and weighs over 35 pounds. With that weight I thought I might have a good chance for grounding. I scraped a small amount of paint off the frame where the bike rack connects beside the rear wheel and also off of the side of the 857. Then I soldered and crimped ring tongue connectors onto a couple of feet of tinned, ground braid. I protected the ground braid by putting it in heat shrink tubing. This ground braid runs from the trike frame and connects to the side of the 857 in the pannier. The grounding experiment worked and I was able to say goodbye to the dragging counterpoise. (Figure 04, Figure 05)

I took a flexible 10 watt solar panel that I used for portable operating and added it to the trike a few years later. Whether I run 5 watts or up my power, the solar panel keeps the battery topped up and keeps me on air. Also about this time is when I replaced the MP-1 with the Buddistick. For the Buddistick antenna I used a 22" Buddipole arm, one coil and their three section shock-cord whip. The shock cord whip doesn't break when I ride under low branches.

Like many QRPers, I like to see how far I can get with my five watts especially on the trike. Last year I had several QRP voice contacts during the Japan International DX Contest. I've also had tricycle mobile QSOs with hams in Germany, Sweden and Holland. Something that has helped make my QRP SSB activity more successful has been an add-on by W4RT for my Yaesu MH-31 microphone (used by the FT-817, FT-857 and FT-897). I got the W4RT One Big Punch speech compressor. Comparing my QRP SSB success before this and after, I had a significant increase in being heard and making more QSOs. This has helped my success in me operating tricycle mobile.

Most of my tricycle mobile QSOs are using SSB. I've experimented with CW having mixed results. If I am stopped on the trike, making CW QSOs is fine. However, if I am pedaling the trike and sending CW it isn't very long before I drift off the side of the trail. This happens even quicker if I am also trying to shoot video. If I can find a mounting system for the paddle that works with the handlebars on each side of my seat, I may be able to send code and pedal at the same time. This is a project I will probably take up after I pick up that final state for my tricycle mobile WAS (Worked All States) award.

Many hams enjoy working towards awards- county hunting, WAS and DXCC among other awards. I think it was in 2010 that I had the thought of doing tricycle mobile WAS (Figure 06). Then in 2011 I had gone back in my log to see what states I had already worked from the trike. I mailed QSL cards out for those states I needed confirmed. Like countless others have found out, many hams return QSL cards and some don't. For those states I didn't get confirmed, I added them to my list of states to work again. I created a spreadsheet to show the states that I needed. I decided to add the date when a state's QSO party was so I knew when my best chance to work that state would be. I also knew that the big North American contests like the North American QSO Party, ARRL Field Day and Sweepstakes were a great opportunity to try and pick up those needed states. As of writing this I need 10 more states confirmed.

I've looked on the ARRL website and didn't see any mobile WAS offered. They have a rule that all QSOs for WAS be made in a 50 mile radius of home. All of my mobile QSOs are made within a four mile radius of home. That doesn't mean I want a regular WAS award since I am having the additional enjoyment of operating mobile. By the time I get that last state if I haven't found a mobile WAS award offered, I may just make up my own WAS award to print and put up on the wall.

At the end of 2010 after being inspired for several years by Steves (WGØAT) great videos, I decided to finally try and make a video of my portable operating. This was completely new to me and besides figuring out the different video quality settings I also wasn't sure what parts of my outing I was going to video. I didn't really have a plan. This video was the first time I used Apple's iMovie for editing.

Figure 5—Ground braid connected to frame of trike

Because of the positive comments I received on that first video, I decided to make another. I continued making videos and now have over 20 videos on YouTube. You can see my videos at www.youtube.com/user/K6BBQsHamShack. Some of these videos are of me operating tricycle mobile. When I shoot video from the trike, I use a hiking stick with a clever device at the end of it called a StickPic. This improves the shots, but I still need to steer the trike while holding the hiking stick (Figure 7).

While doing tricycle mobile, I've had QSOs with other hams who do portable operating like Steve, WGØAT who enjoys doing SOTA activations with his trusty pack goats Rooster and Peanut. Another ham I've had QSOs with is Paul, WØRW with his military manpack radio who can be found on Pikes Peak, and national parks among other locations. I also find it fun to have QSOs with hams aboard museum ships including the WWII submarine the USS Pampanito, the aircraft carriers the USS Hornet and the USS Midway. Each of these is a unique contact for me and I hope that having a QSO with a ham on three wheels is a unique for them.

Figure 6—Tricycle mobile beside the North San Francisco Bay

I enjoy hearing when a ham says they've never contacted a bicycle mobile station before. I feel that it has given them something that they can later tell their ham friends, "guess who I contacted today?" The same goes for hams having QSOs with Steve, WGØAT, Paul, WØRW and the many others doing unique types of operating. Besides bringing a smile to the hams contacting these stations it also lets them know that ham radio isn't limited to operating from home, the car or from the park for Field Day (Figure 8).

Many people ask questions about the trike such as "how do you steer it?"

The trike's steering is controlled using what is called under-seat steering. With hand grips to control the steering, braking

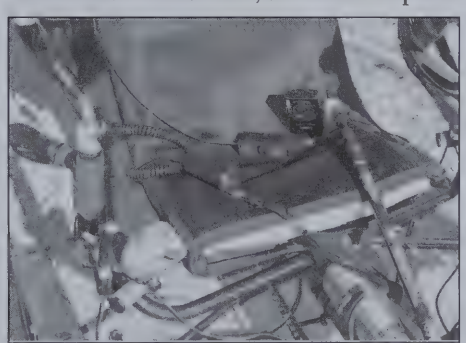


Figure 7—Tools: Yaesu mic, PalmPaddle and StickPic holding my digital camera

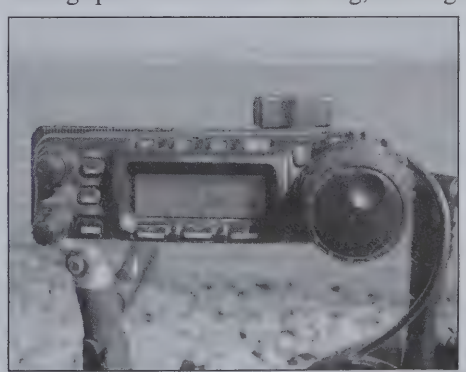


Figure 8—Control head of the FT857 tuned to the 20 meter Hfpack frequency.

Figure 9—Trike beside the bay with Mt. Tamalpais in the background

Figure 10—My award from the 7th Area QSO Party!

and shifting are on each side of the rider, the handlebar runs underneath the seat. Some ask if the trike is easier to ride than a two wheel bicycle. I find it easier, with the exception of going up hills which takes me longer. I don't feel that I need any exercise during the week in order for me to be able to get out and ride around on a Saturday. I don't push myself or ride fast, I just take an easy pace. Besides being very comfortable, the seat of the trike takes a lot of pressure off of my back. I encourage other hams to switch to three wheels, it is fun whether or not you install a ham radio station aboard it. With three wheels you won't have to concentrate on balance and can put that attention towards eating a burrito while you ride, just like I do in my tricycle mobile videos.

I have a lot of fun operating tricycle mobile. I tell hams that for me operating portable is great making QSOs while pedaling the trike is a blast! (Figure 9)

A Last Word

Just as this issue of the magazine was being sent to the publisher, I received word by e-mail that my tricycle mobile station had received a first place award (Figure 10) for outside area mobiles from the 7th Call Area QSO Party. So now, I have an award winning tricycle mobile station!

QRP and Me

Martin Huyett—KØBXB huyettmeh@gmail.com

I had little interest in QRP for the first forty six years of my Ham Radio life. Mostly my rigs consisted of middle of the road pieces, ranging from the old Millen 90800 that I started with back in 1958, through a Heathkit DX-60, Heathkit SB-300-400 pair and more recently a variety of Icom and Yaesu 100 watt rigs. In the '80s and '90s, like a lot of people, I got too busy for ham radio, what with kids, work and a bourgeoning interest in computers so was literally without HF gear until 2004. Six things got me back into it again, two humans and four acts of God! The humans were a brother-in-law in Michigan and a fellow attender of the Sunday School class in First Baptist Church in Orlando, Florida, both hams. Curiously, neither of them is still active but I am hopelessly caught back up into this addicting hobby. God's overt part came in the form of four hurricanes that crisscrossed Orlando where we lived in 2004.

Figure 1—Yaesu 817.

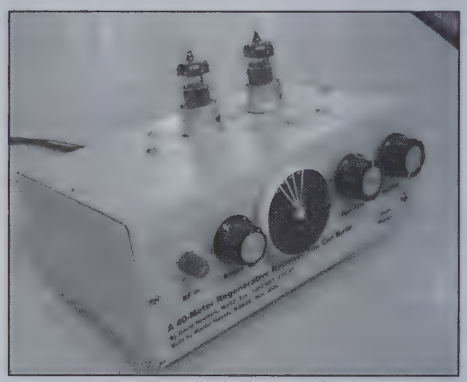


Figure 2—DC 40a transceiver.

The first one left us and our neighbors without power, phone and for those of us on a well, without water in the sweltering heat and humidity of late August. I don't know that I have ever smelled so ripe either before or after that week! Knowing the storms were coming, and having been bothered by those two humans for weeks prior, I had the presence of mind to dig out my old Icom IC-2AT two meter hand held and put some batteries in the Axillary AAA battery holder and after wearing a blister on my thumb tuning around found and listened to the local hams manning the various shelters. That reignited the fever, and when the power returned, enough trees were off the roads and I could once again buy gas for the car, I went to AES in down town Orlando and bought an Icom IC-706KMIIG rig, rigged up a G5RV antenna and began working my way back into Ham Radio.

How does that relate to QRP? Well not long after, my hankering for using a soldering iron began to return. Fishing around on the Internet I found and bought a little one transistor Pixie 2 HF transceiver. I'm not sure if it put power out or soaked it up, but I actually managed to have one or two 40 meter contacts with it.

My CW was terrible so they were short contacts. I had always hated CW and within minutes of getting my General back in high school in the late '50s I picked up the mic and never looked back. But a local ham friend in Florida shamed me into giving it a chance. He suggested that I simply listen for about half an hour a day to CW QSO's and when I felt like it, give it a try. To my amazement in a couple of weeks I

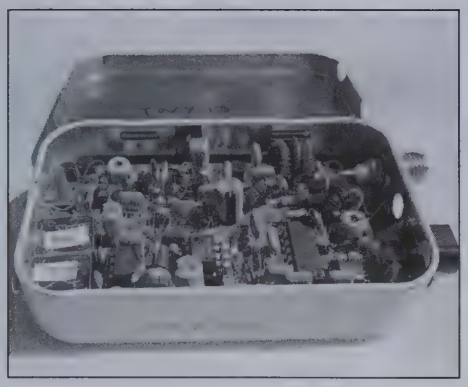


Figure 3—40 Meter regenerative receiver.

Figure 4—40 Meter simple transmitter.

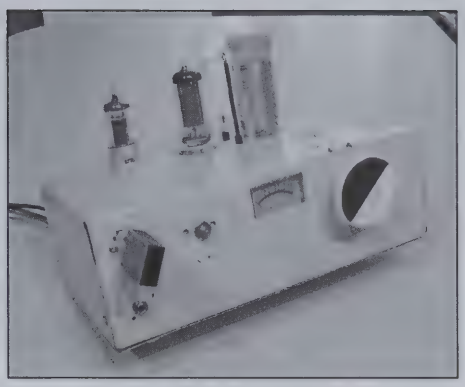


Figure 5—NS-40 Class E transmitter.

began venturing out. It was more fun than painful so I continued, and now, for the last six or eight years, CW has been my favorite HF mode! I'm not fast but can rag chew for a long time at 15-18 wpm which is what I like to do.

My next QRP venture was to purchase a Yaesu FT817nd (Figure 1). I bought it mostly because it was cute. But soon I found myself using it instead of the 706. I just got an unexplainable charge out of a QSO at five watts or less. But at heart I am a hands-on engineer and like to build stuff. So several years ago, after moving to Wisconsin, I stumbled across QRPkits.com and bought their DC40a (Figure 2) transceiver that fits into an Altoids box. It puts out about one watt, is full QSK, and though the receiver is direct conversion works amazingly well. Being totally crystal bound, you just wait for someone to come close enough to pounce or simply call CQ. I logged twenty nine QSOs with it between January of '08 and December of '11. Talk about a buzz! There is just something magical about having a QSO using an Altoids box! Plus, everyone in the family likes it. The girls think it is cute and the guys are amazed that it works!

I had always wanted to build, more or less from scratch, some tube based gear. So I settled on a schematic in the September 1992 *QST* entitled "A 40 Meter Regenerative Receiver You Can Build" (Figure 3). My version took shape in May 2009. And to my shock and delight, IT WORKED. I've had twelve QSOs with it. You talk about radio magic! Nothing in ham radio exceeds the thrill of hearing a home brew regenerative receiver come to life with real live signals. But then I needed a matching transmitter!

I ultimately selected the schematic of a two tube transmitter published in the January 2003 *QST*, "The Two Tube Tuna Tin Transmitter." It is almost identical to the one published in October 1968 *QST* entitled, "A Simple Transmitter for the Beginner." Using a 6C4 oscillator and 5763 final, it puts out about four watts on 40 meters (Figure 4). It is a neat little transmitter and I still use it now and then, just to enjoy my own handiwork. It is kind of fun to tell the other guy that I'm using my own built-from-scratch transmitter. My first QSO with it was with KB5CQR in MS in July of 2009. And by the way, the receiver for that QSO was my little Regen!

In August of '09 I bought a NS-40 Class E transmitter from Four State QRP Club (Figure 5). I had never heard of Class E before and was fascinated by the very small number of parts and very high efficiency. My first QSO was with WY3H in PA, about four hundred miles. That rig is just plain elegant. Simple to build and simple to use. But puts out one of the cleanest Crystal derived signals you can imagine. I still use it fairly often, recently teamed up with the Four States SS-40 receiver and their MagicBox TR switch, all kits. And by the way that SS-40 receiver is one of the quietest receivers I have every used, even compared with my Icom IC-7000 transceiver. Just a week ago I purchased, built the Four State standalone VXO and added it to the NS-40. I'm still debugging that setup, but it does work.

One aspect of home brewing that I enjoy is building enclosures for my toys. Thanks to retired dishwashers and microwaves I have a good cheap source of easy to work with sheet metal. I found an 18 inch sheet metal brake at Harbor freight

Figure 6—Stack of 4SQRP kits working together.

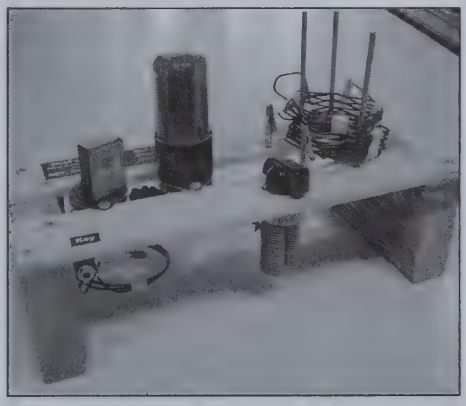


Figure 7—Inexpensive 6V6 transmitter on a wooden "chassis."

Figure 8—The TenTec R4020 QRP transceiver.

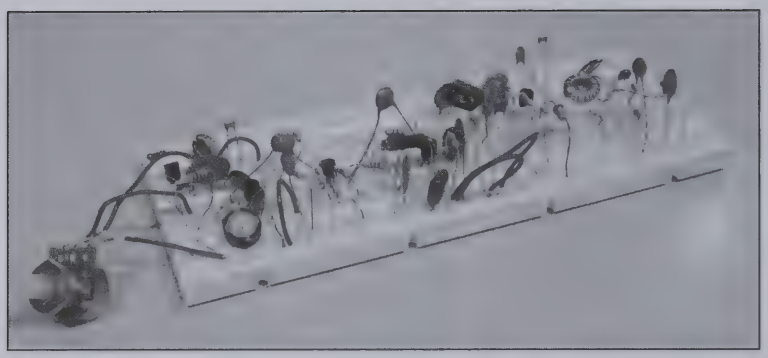


Figure 9—30 Meter transmitter.

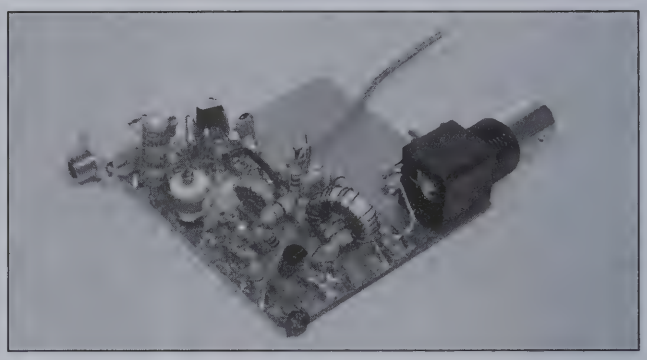


Figure 10—Manhattan version of the 30 M transmitter.

and a similarly cheap drill press at the local Home store. Combine those tools with my trusty tin-snips and spray paint I can build anything. The photo shows one result, the Four State QRP stack (Figure 6) in matching cabinets.

That pretty much made up my QRP gear until a year ago. I was in a QSO with a WB8DQT in Mason, MI in April last year when I learned that he was using his version of that two tube transmitter mentioned above. We compared notes during the QSO and via email afterwards. And, by the way, he had the feature article on his transmitter in the Jan 2012 *QST*, titled "Vintage Low Power Radios." Oh, and mine is in one of his pictures! One of the neatest QRP contacts I've ever had was the next day when we had another QSO, each using our "matching" home brew transmitters!

But that first QSO with WB8DQT is what gave birth to my very favorite QRP transmitter. On his web site he had a photo of a little one tube transmitter built on a wooden slat chassis. I had wanted to build that transmitter when I was a kid. It appeared in some handbook or something that I had back then. A bit of research took me to the original design article entitled, "The Most Inexpensive Transmitter" in the December 1946 *QST*. The article by-line is, "A Complete Crystal Oscillator for $3.95," written by Byron Goodman, W1DX.

Digging around in my junk box(s) I found almost everything I needed, even the 6V6 tube (Figure 7). So on April 13, 2011, at 0152 UTC I had my first QSO, with WØRT 521 miles away, in Kansas, just 150 miles south of where I lived during high school and first drooled over the picture of that transmitter. By the way, my most recent QSO with it was just a few weeks ago, with NG9D in Plainfield, IL.

My latest QRP acquisition is a Ten Tec R4020 40m/20m transceiver (Figure 8). It entered service in August of last year, just before an overnight canoe trip with my son in Western Wisconsin. I was planning to use it on the trip, which didn't happen because the trip got cut short. But like all the rest, I love it. Small, unbelievably capable on both receive and transmit, it is unfair competition for the Regen receiver and one tube transmitter. But it is a relatively inexpensive and makes it very easy way to do QRP without giving up much big-rig performance, other than Power.

Finally, when the Spring 2012 *QRP Quarterly* arrived recently I paused over the article by Rev. George Dobbs entitled "A Classic Transmitter!" It described a two transistor 40 meter transmitter originally designed by Doug DeMaw back in the early '90s. It inspired me to try to build something similar for 30 meters. So I pulled out my breadboard and went to work (Figure 9). It is a long way from marketable but I did build up a version of it using the Manhattan style of construction (Figure 10) and had two QSOs with it!

It is fair to say that I like QRP. I'm not QRP only. But QRP offers many opportunities to build and modify stuff. It also makes operating fun and challenging. And there is something special about talking half way across the country with one of those homebrew tube-based ones. It is healthy to keep a grip on where we come from, and be amazed that those most basic designs of the past still get the job done. I won't be selling my Icom IC-7000 anytime soon, but perhaps sooner than that little 6V6 job which may be the only thing I pass on to my kids with the requirement that it stay in the family—forever! Give QRP a try and I promise you will have fun. After 300 QSOs at 5 W or less, and countless piles of attempted designs, I for one, wouldn't be caught without QRP (Figure 11)!

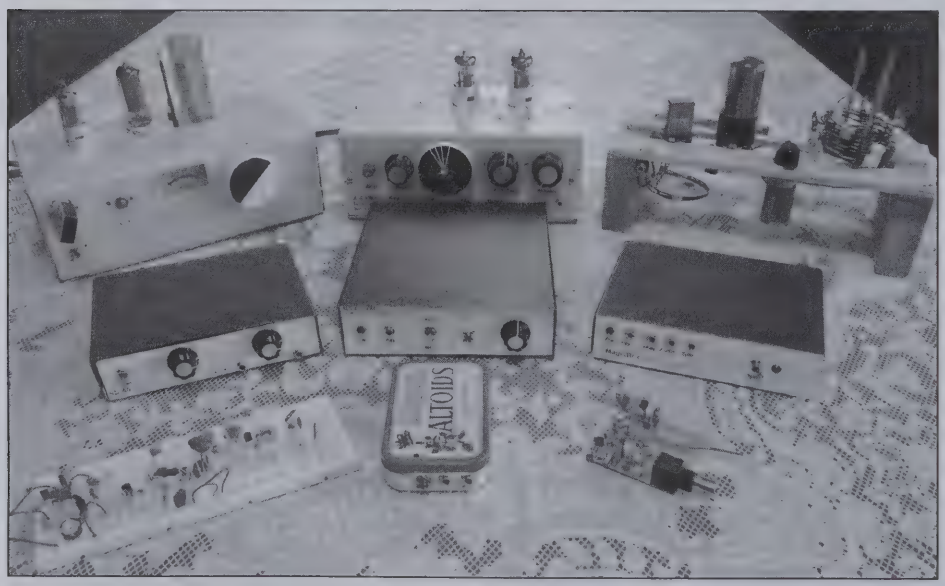


Figure 11—KØBXB's collection of QRP gear.

Cool Stuff for Active QRPers!

New! Add Some Class to your Shack!

Wooden plaque with your callsign, on 7" × 7" hardwood.

Available from: www.HamPlaques.com/o-qrp.htm
(QRP ARCI receives a commission from these sales)

Get Mugged!

Generous-sized coffee mug with the club logo on both sides. The mug is gray with printing in blue.

$10 ea. postpaid

Be a Well-Dressed QRPer!

Golf shirts with the QRP ARCI logo over the pocket, and your name & call on the right side. Red, White, Green or Blue, and don't forget your size.

$30 ea. postpaid

Handy Gadgets & Publications

Pocket Magnifier
See all those little parts!
$1 ea. postpaid

QRP ARCI CD/DVD Holders
Store up to 24 important discs.
$9 ea. or 2 for $15 postpaid

Official QRP ARCI Patch
3-1/2" × 2-1/2" sew on or iron on.
$5 ea. postpaid

25 Years of *QRP Quarterly* on CD or DVD:	$30 members; $35 non-members
10 Years of FDIM (1996-2005) on CD	$18
2010 Dayton FDIM Proceedings (printed)	$15
10-year CD and 2010 printed Proceedings	$25
Dayton FDIM Proceedings—2006-2009	$10
While supplies last—1996-2005	$7
***How to Achieve 20 WPM CW With No Effort on Your Part,* or, *I'm Lazy and Don't Want to Work at it,* by Ron Stark, KU7Y**	$6

- *All prices postpaid to U.S. addresses*
- *Add $3 for North America outside the U.S.*
- *Add $5 for DX outside North America*

The QRP ARCI Toy Store

PO Box 41
Moodus, CT 06469
Purchase by check to "QRP ARCI" or by
Pay-Pal to ToyStore@qrparci.org
Find us on the web at www.qrparci.org

Dual Gate MOSFET Odyssey: Part III

Pete Juliano—N6QW radioguy90@hotmail.com

A Souped Up Local Oscillator

In the 1950's, the term "souped up" frequently referred to "hot" or high-performance cars often built by teenagers, mostly from junk parts. At that time, it applied equally as well to many young ham operators who built "hot radios", frequently from junk parts because they were usually without much in the way of funds. One of the most daunting challenges facing those home brewers was finding a low cost way to make the stable frequency source so necessary to a high performance receiver. Not much has changed today in that we still have a desire to have a "stay on frequency" radio. In fact, the widespread use of single sideband and digital operating modes has made this requirement even more essential.

The good news is that we have some really wonderful technology available to us at modest cost, such as DDS VFO's or devices such as the Si570 frequency generator kits or even add on kits to older radios such as the frequency stabilizers from Cumbria Designs known as the X-Lock-3. But, even these tools are a bit expensive for simple receivers, transceivers or signal sources. That led me to thinking about a low cost analog approach to a stable frequency source. Could low cost modern components be used with tried and true circuitry from the past to make our "souped up" radio? The answer is "Yes" and this article will show you one way to do it. Of course, we will be using those super-cheap Dual Gate MOSFET's (DGM's) that we used in the previous articles in this series.

Let's start by reviewing some of those well used techniques, as they will be important to our finished product and may guide your thinking if you are new to homebrewing.

So what causes instability in oscillators? That is almost like asking how big is big. There are many factors such as:

Mechanical Stability—If any part of the frequency-determining components of an analog oscillator can move easily, the resulting circuit is almost sure to be unstable. Some of the bargain receivers available in the 1950s suffered frequency movement from something as simple as the mechanical vibrations caused by using a CW straight key on the same shaky table as the receiver. Has anyone reading this ever owned a Hallicrafters S-38 receiver? Radio magazines of the 1950s/60s published "best practices" articles on how to physically mount variable capacitors for maximum stability. The same best practices applied to the mounting of tank coils. In Part I of this DGM series, I discussed how to mount the toroid inductor for the LO using a plexiglass "sandwich." Thus, even today we must pay attention to physical mounting.

Heat—That four-letter word says a lot. As components are heated, they tend to change values and thus cause the oscillator to "wander" about. Many of the early signal sources were vacuum tube devices that generated a lot of heat. Some elaborate designs actually used temperature controlled ovens so that selected portions of the frequency determining circuits were brought up to temperature, but that temperature was tightly controlled. Thus, after an initial drift the oscillator was highly stable. With the advent of solid state oscillators, much of the heat problem was removed. But attention still has to be paid to proximity heat sources, as that still could affect other components. For example, one well known solid state transceiver made in the late 1970s/early 1980s used a solid state permeability tuned oscillator (PTO), meaning a gear driven tuned inductor was the basis for frequency change. PTOs are generally quite stable mechanicially. However, this PTO was mounted in close proximity to two peripheral heat sources—a 6.3 V, 150 mA pilot light and the heat sink of the final amplifier stage. Some of these high end manufactured units experienced drift because of these peripheral heat sources. A key source of this type of drift is often capacitors. Many capacitors will vary in value, either positively or negatively, as a function of ambient temperature but one type is quite stable. These stable capacitors will be labeled either NPO or COG, meaning zero drift with temperature, and should be used in any frequency determining circuit unless otherwise noted.

Component Quality—Today, we enjoy components that meet exacting quality standards and the manufacturing tolerances are amazing. Many of today's designs specify 1% resistors, which are common parts and not that much more expensive than those of 10% tolerance. Purchasing 1% resistors in the past was expensive as it literally required a hand sorting of production parts. Today, it is a manufacturing process that determines the tolerance and it is that same close parts tolerance that lends itself to "less drifty" designs.

On/Off Oscillator Keying—Rapid starting and stopping of the oscillator, such as you would have if you directly keyed a VFO, often caused frequency instability in the resulting signal, i.e. "chirp". On way to avoid this problem used a heterodyne approach where the VFO portion was always on, thus thermally stable, and a second, more stable crystal oscillator was keyed. The resulting two signals were added (or subtracted) in a mixer stage and the resulting output was potentially more stable than a singular approach. Virtually all of these approaches involved a follow on buffer amplifier to prevent the loading (changing frequency) of the oscillator.

We will use all of the above techniques, implemented with current generation components and our second generation DGMs to generate a decent, stable, keyable signal on 40 Meter CW.

Shown in Figure 1 is an LO board that I initially built for use in my Dual Gate MOSFET Direct Conversion Receiver project that appeared in the Winter 2012 issue of *QRP Quarterly*. The circuit contains many components and I elected not to use it for the project as it would greatly add to the complexity (and cost) of the DCR. But I did have thoughts of turning this LO into a standalone transmitter. Thus, Part III will look at this circuit and discuss some of the features as it would be used either as a LO or a transmitter. If you like, you can even retrofit your Direct Conversion Receiver with this oscillator.

While it may not be evident, this small board is a mix of SMD and through-hole parts. The device complement includes two SMD versions of the 2N3904 and two

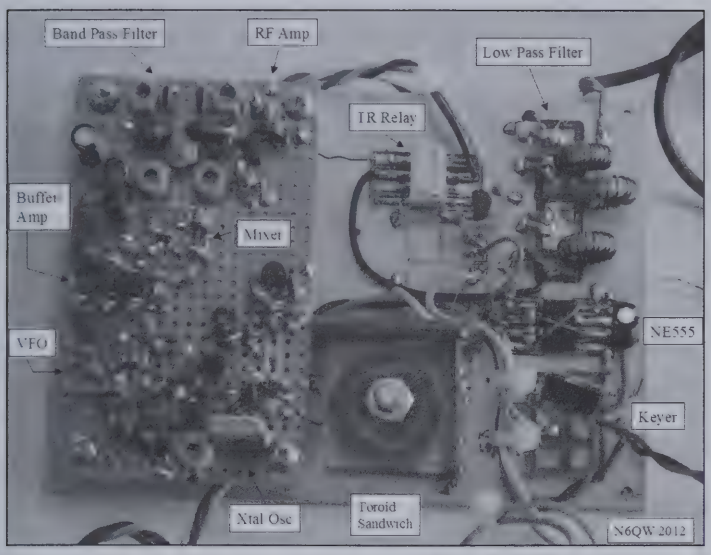


Figure 1—Photo of the completed LO board.

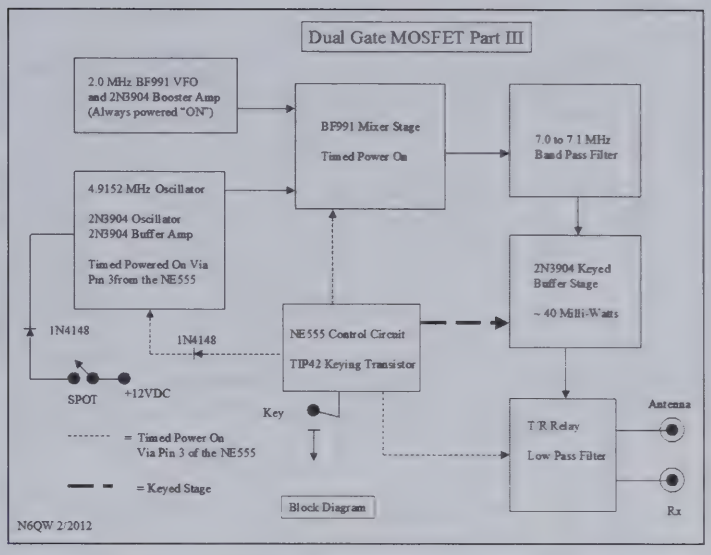


Figure 2—Block diagram.

SMD BF991 Dual Gate MOSFETs along with two TO-92 versions of a 2N3904. For good measure on the second board we have one IC and a power transistor. Figure 2 is a block diagram of the project and includes the following distinct circuit elements:

• 2.09 to 2.140 MHz Dual Gate MOSFET VFO—A BF991 DGM is used for the VFO portion. By choosing this low a frequency for a VFO, the capacitors and inductors are large in value. So, any change in values translates to a very small frequency change. The availability of metal type variable capacitors is rapidly decreasing and thus a varactor diode was chosen as the tuning device. The specific unit selected has about a 30 pF range and that also limits the frequency excursion as it is in parallel with a number of fixed capacitors. Initially I had the VFO tuning a lower range (below 2.0 MHz) and the delta frequency spread was much smaller. By using a lower frequency crystal oscillator with a higher frequency VFO it was possible to achieve a 50 kHz frequency spread so that the lower 50 kHz of 40M is covered. [2.09 + 4.9152 = 7.005 and 2.140 + 4.9152 = 7.055] Using a small trim cap, I purposefully set the lower edge to 7.005 MHz. Without some accurate frequency measurement device I did not want to risk out of band operation. Essentially, the 50 kHz window can be moved about somewhat and for those who would like to operate say from 7.020 to 7.070 MHz, that is easily done. However, the Band Pass Filter has a center frequency of 7.050 MHz and a bandwidth of 100 kHz and thus becomes the limiting factor. For good measure, I included a booster buffer amp (2N3904) following the first BF991 as this provides a constant load for the VFO.

• A 4.9152 MHz Crystal Oscillator/Buffer Stage uses SMD versions of the venerable 2N3904. By mixing the signal from the VFO and the oscillator, the additive portion covers from 7.005 to 7.055 MHz.

• A Dual Gate MOSFET mixer, a second BF991, is used to combine the signals. Special care was taken to enable adjusting the signal levels via trim pots so that the BF991 is not over driven.

• After the mixer stage is a 7.0-7.1 MHz Band Pass Filter to insure the output is only in the part of the band we want.

• Following the Band Pass filter is a keyed buffer stage. The output from this stage is 4 volts peak to peak. That is equivalent to a 40 milliwatt signal. QRpppp anyone? If someone intends to do this be sure to include the Low Pass Filter in the circuit to comply with the FCC requirements.

• A separate board contains the control circuitry, keying transistor and low pass filter stage and consists of a NE555, TIP42 Keying Transistor, the W3NQN Low Pass filter and a T/R Relay.

The theory of operation of this circuit is as follows. The VFO is on all of the time! So, many of the issues that plagued early frequency generating devices, such as thermal stability and transient behavior, are addressed as a result. The keying circuit does two things, the first of which is to start the timing cycle on the NE555. When the key is depressed, putting the NE555 into action, a voltage appears on Pin 3 and the duration of that voltage is governed by the timing capacitor, the 4.7 uF electrolytic. That voltage is routed to the 2N3904 Oscillator and Buffer stages, the 2N3904 amplifier following the VFO and also powers on the BF991 mixer stage. Thus the 7.0 MHz signal going into the Band Pass Filter is "On" during the keying sequence. The keying transistor supplies power to the buffer stage following the Band Pass Filter but only during "key down". Thus, the buffer is the only stage that is keyed and leaves the other stages to remain on (and stable) during the course of the CW generation. Pretty slick and stable. Recall that the output power here is 40 mWatts as stated previously. So if you are going to use this VFO in a transmitter, you will likely need some amplification stages. The amplifier stages following the VXO in Part II would certainly be an ideal match. As in the Part II Transmitter, a spot function is provided. Caution: DON'T forget the isolating diodes or you will smoke the NE555.

Figures 3 through 5 are the schematics for the various circuit blocks. As is frequently done in my projects, I attempt to use as many proven circuits over and over to assure success and consistent results. For those who have followed my projects, you will see that Part III is no exception.

The key to this project, as with the prior two projects in this series, is the availability of the low cost Dual Gate

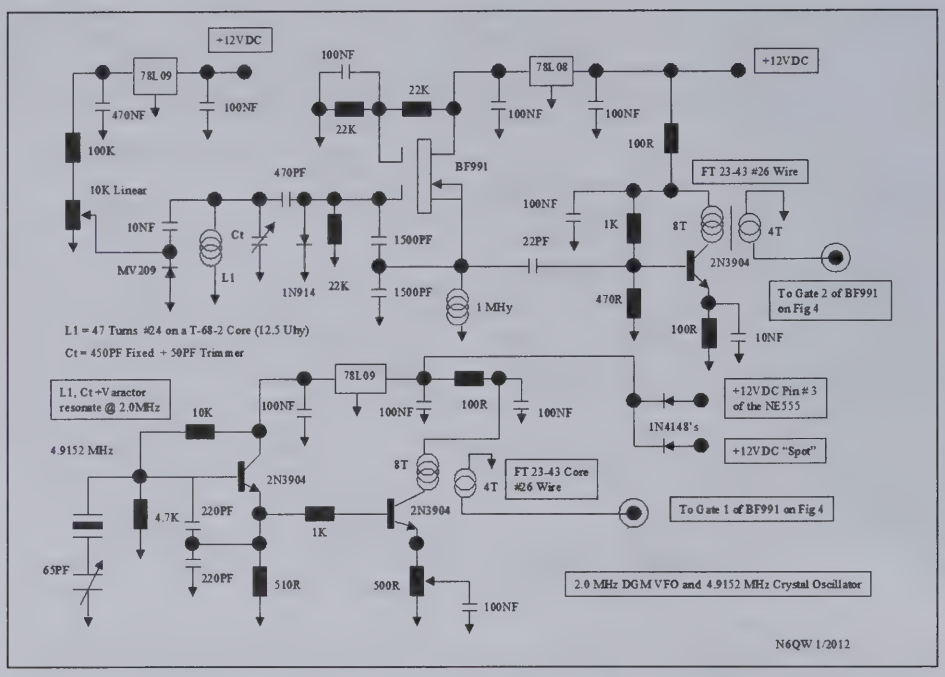


Figure 3—Circuit block schematic: VFO and Crystal Oscillator stage.

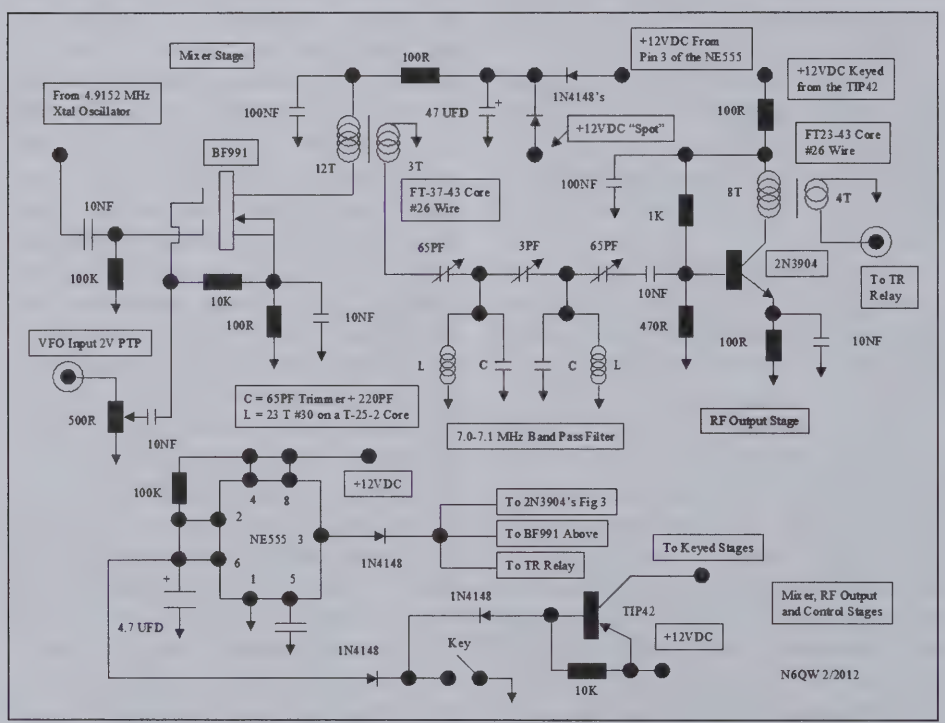


Figure 4—Circuit block schematic: Mixer, Band Pass Filter, RF Output and Control stages.

MOSFETS. At roughly 40 cents each for the BF991's and mere pennies for the SMD 2N3904's, this is a very low cost approach to having a stable CW signal on 40 Meters.

I would like to refer those who undertake this project to my website, www.jessystems.com and the link entitled "Konstruction Korner". In that section, I explain how to utilize the single sided vector board for the DGM and several of the close up photos in that section are of this specific project. Another link within the Konstruction Korner details the use of a varicap diode in place of a variable capacitor. These two sections complement this article and should be referred to for this construction.

My usual approach to projects of this type is to get small portions of the radio built and tested before proceeding onto the next stage. I really try to avoid building everything at once and then subjecting the whole radio to a giant smoke test. I would like to suggest the following construction sequence.

1) 4.9152 MHz Crystal Oscillator Stage—The Konstruction Korner link details the construction of a RF probe. If you haven't built it make that item #1. With the probe and an outboard general coverage receiver, (or frequency counter) you can determine if this circuit is working properly. An Oscilloscope would also be handy but not essential. The test process should include temporarily tack soldering a 50 ohm resistor across the output to provide a proper load for the oscillator and providing 12 VDC to this circuit as the control circuit is not built at this time. Visually observe the output level as the small trim pot is adjusted. Note the output levels by jotting down what is observed. This data will come in handy should a problem show up at some later time.

2) Next build the VFO portion and test it by visually observing the VFO output following the 2N3904 booster/buffer stage. Do this by providing a 12 VDC power source and the temporary 50-Ohm load discussed previously. Place the RF probe across the temporary load to test the output. A general coverage receiver or frequency counter would be helpful in setting the range. Here again an Oscilloscope would be handy to observe the output of the stage. A good test for the VFO is to set it on a frequency and after a short, 15-minute warm-up period, measure any drift. The Ct capacitor shown in the diagram is comprised of multiple NPO capacitors in parallel. I used several 150 pF, a 39 pF, a 15 pF, all NPO type and an NPO trimmer. One of the theories involving drift reduction is the use of multiple capacitors so that the circulating current in the tank circuit is shared among several capacitors and the heating effect is minimized. This is like using ten 100 ohm, 1watt resistors in parallel across a 10 volt supply. The effective resistance is 10 ohms and the total current is 1 A. But each resistor is only seeing 100 mA of current so the heating effect across

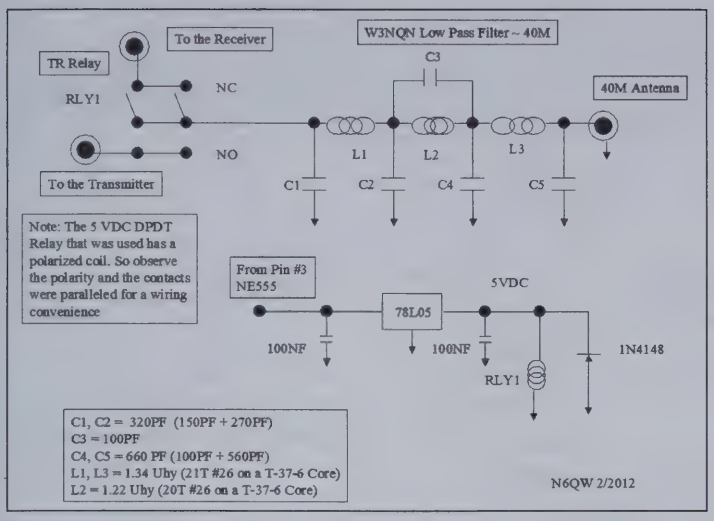


Figure 5—Circuit block schematic: TR Relay, Band Pass Filter and Spot function.

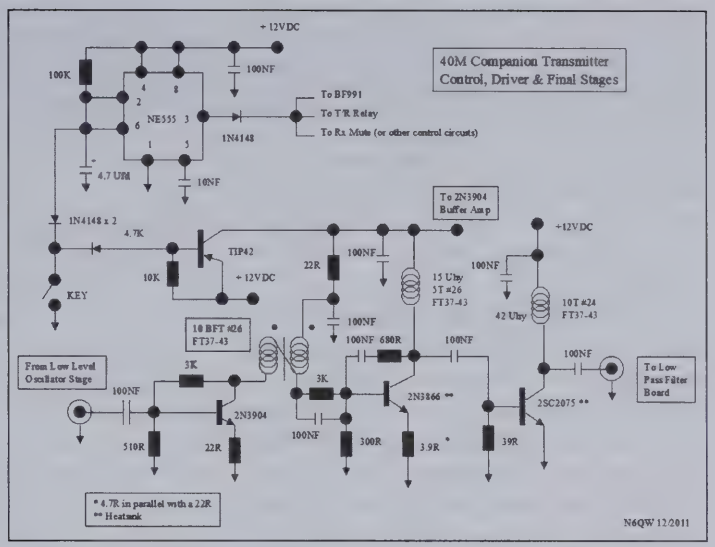


Figure 6—Shoes for the transmitter (reprint from, Part II).

each individual resistor is only one watt but across the entire group is 10 watts.

3) The BF991 Mixer is next on the list and it is here where max smoke may not be the best tuning approach. The BF991 must not be over driven and thus two trim pots are used to adjust the signal levels. One of those pots is part of the 4.9152 MHz crystal oscillator stage and the other is located in the Gate 2 circuit of the BF991 Mixer stage. Final setting of the trim pots is best done after the Band Pass Filter is installed. For now, set both pots about mid-way in their adjustment range. Temporarily supply 12 VDC to this stage as well as powering the other two stages and include a temporary 50-ohm load at Point A on Figure 4. Use the RF probe to determine there is an output from the mixer stage. There are actually two (or more) signal streams coming out of the mixer stage which include the sum and difference frequencies of the mixing process. We of course want the sum and that will only result when the Band Pass Filter is installed.

4) To facilitate the final testing of the circuits now would be the time to build the control and keying circuits which is the NE555 and the TIP42 keying transistor

5) Next in line is the Band Pass Filter. The adjustment of this circuit requires that a 50 ohm load be connected on the output side of the filter and this becomes a test point. Using the RF Probe and a ham band receiver, set the VFO so the resulting signal is at 7.050 kHz, which is the center frequency of the filter. Key the transmitter and tune for maximum signal strength. This will very likely require several passes through the adjustment process. Note the value of the S-Meter reading or RF probe value. Next tune to the low end and observe the readings as there may need to be some tweaking so that the band pass is somewhat flat and not peaked at a singular frequency. With a little practice and patience this can be done rather quickly. Having an Oscilloscope will greatly aid this alignment. Part I of the series discussed this same process. One possible approach would be to temporarily shift the tuning range from 7.025 to 7.075 MHz and make the alignment of the BPF so as to achieve a flat band pass. Once that is done then the tuning range can be set back to the low end. Finally make the adjustments to the two trim pots and observe the RF output and the S-Meter for a maximum signal. Do not overlook listening to how the signal sounds. It should sound like a clean, single note in a receiver. If not, you probably have a problem.

6) Following the Band Pass Filter the 2N3904 keyed stage should be built and tested using a 50-ohm load connected to the output of this stage. Take voltage measurements and write those down for future reference.

7) The last to be built would be the T/R Relay and Low Pass Filter. See Figure 5.

The final test is to connect a 50-ohm dummy load to the antenna port following the Low Pass Filter and make voltage measurements. The voltage should not deviate too much from those observed in the next to the last step. Listen to the signal on a ham band receiver and when you are convinced all is well replace the dummy load with an antenna and try your hand at making a contact or two.

As stated earlier, 40 mW QSOs are possible but consideration should be given to adding power amplifier stages similar to what is shown in Part II if you are going to use this VFO in a transmitter. Figure 6 is a reprint from the Part II and can be used as a guide to facilitate adding some "shoes" to your VFO. Other modifications will be required for TR switching and control. I will leave those modifications to the readers. The control stages shown in Figure 6 would not be required as the control circuits used in Figure 4 can handle the power requirements for the final stages. There may be a need to 'knock down" the 40 mW to prevent overdriving the final stages. A simple Pi Type attenuator comprised of three resistors with two 300 ohm resistors used in the parallel legs and a single 18 ohm resistor for the series leg will give a 3 dB attenuation which effectively means about 20 mW of drive. This attenuator would be placed at the input shown on Figure 6.

In review, two Dual Gate MOSFETs were used in this project, one as an oscillator and the other as a mixer. These are indeed versatile, low cost devices that enable us to update some of the circuits of the past and try our hand at a "souped up" radio transmitter.

—73, Pete N6QW

Designing a Solar Power System for QRP Operation

Mert Nellis—WØUFO mertnellis@msn.com

Designing a solar power system for your QRP station can be done without too much fuss and bother, and you will probably be very proud of your additional capability.

Let's start with a block diagram of a typical system, shown as Figure 1. The solar panel is connected to a controller, a current indicator, and diode which charges the station battery, and the transceiver and accessories are connected to the battery. The controller limits the charging current to a specified value and some versions of controllers reduce the current to a trickle when the proper terminal voltage for the battery is reached. A diode, D is provided separately or as part of the controller to prevent the battery from discharging into the controller or solar panel and a current indicator is helpful to see that the solar panel is actually providing energy. Possible current indicator circuits are shown in Figures 2 and 3. An analog indicator can be made from a 0-1 mA DC ammeter. A digital indicator can be made from a 0-200 mV digital voltmeter as shown in the figures. The battery is capable of extremely high short circuit currents so a fuse or breaker is recommended directly from the battery to protect the components and wiring from accidental short circuits.

Solar power system design is usually a matter of trading off power requirements against the cost of the battery and solar panel. Once you have decided on a battery type and ampere-hour capability, its charging requirements can be determined. If the subject of battery charging is new to you, there are many on-line discussion groups and the white paper by Duffy, KK6MC ("Dr. Megacycle"), www.wa0itp.com/batteriesandchargingsystemskk6mcwhitepaper.pdf, is very good. When your battery charging requirements are known, then one of the circuits discussed in this article can be used to control your solar panel output for safe battery charging.

Some small, low current solar panels can safely charge a battery without any control but larger, high current panels require a controller to limit voltage, or current or both voltage and current. If the full sun, open circuit voltage and short circuit current are known for a panel and the requirements for charging a battery are given, the need for a controller can be determined. If you don't know the above characteristics for your panel, they can be determined by some simple testing as outlined in my article in the February 2012 issue of *QST*. The tests result in a V vs. I curve, such as is shown in Figure 4. Open circuit voltage is the point on the curve where no current is being drawn and short circuit current is the point where voltage is zero. If the short circuit current for the panel is equal to or less than the desired charging current, no current control is needed. But, it is convenient to have a voltage limit indicator in order to determine when the battery reaches its end-of-charge voltage. Figure 5 shows a useful voltage monitor that will indicate four different levels of battery voltage. It can be calibrated for the levels that are best for a particular battery type. Once a full charge is reached, it's best to remove the battery from the charging system to prevent battery damage unless the proper floating charge can be provided.

If a controller is necessary, there are two main types—controllers that regulate current only and those that regulate both output current and output voltage. Current-only controllers are capable of limiting charging current to a value commensurate with a particular battery, usually 10% of the amp-hour capacity of the battery. Controllers which regulate current and voltage have a significant advantage, in that voltage control can reduce or even effectively turn off the charging current as the battery reaches full charge. The better controllers of this type have the advantage of being able to continually connect to the storage battery without damaging it due to overcharging.

Commercial solar controllers are available but if you are a DIY Amateur Radio operator, a controller can be made quite easily and effectively, possibly using parts from salvage. The controller should not create RFI so that batteries can charge while operating a receiver. For this reason, I prefer using a pass transistor type controller rather than a switcher and the following circuits reflect this preference. Each circuit has a pass transistor that must control the charging current, a current sensing shunt, and voltage sensing from a reference voltage. If integrated circuits are used, some of these elements may not show explicitly in the schematic. In many

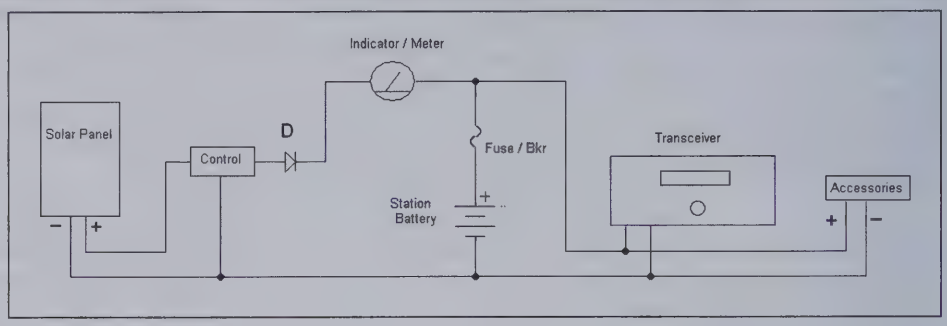


Figure 1—Typical solar power system.

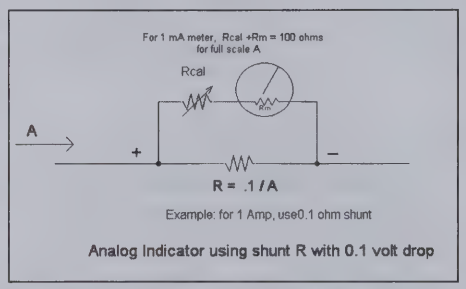

For 1 mA meter, Rcal +Rm = 100 ohms for full scale A
Rcal
Rm
A
+
–
R = .1 / A
Example: for 1 Amp, use0.1 ohm shunt
Analog Indicator using shunt R with 0.1 volt drop

Figure 2—Analog current indicator.

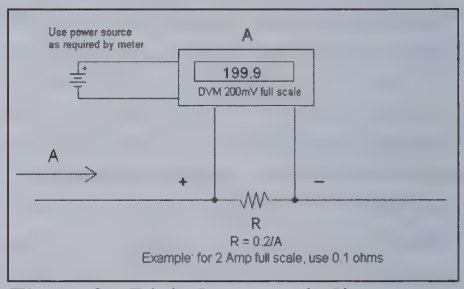


Figure 3—Digital current indicator.

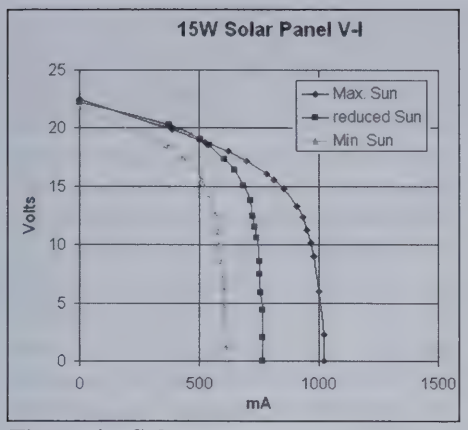


Figure 4—Solar power current vs. voltage curve.

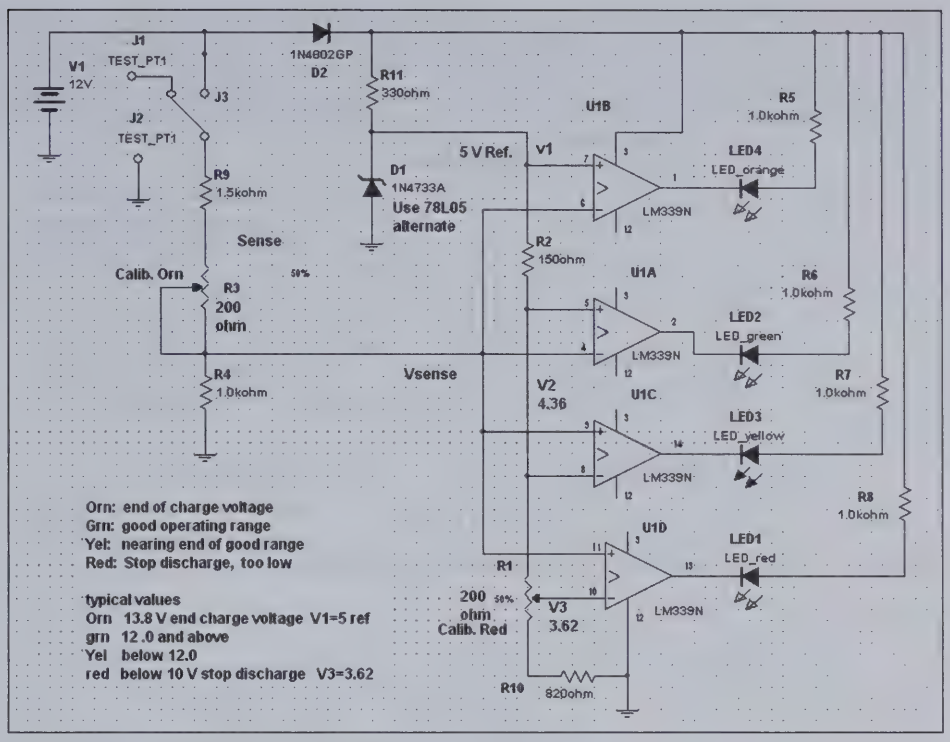


Figure 5—A useful voltage monitor.

cases, the pass transistor must dissipate a lot of energy to regulate the output but the energy is free so should not be a problem. The energy dissipation does often call for the pass transistor to have a heat sink, a fact which should be considered in any design. Maybe for field use the pass transistor heat sink could keep the coffee or soup warm.

Figure 6 shows a simple current-only controller with a fixed output current set by the sensing element R1. Too much current causes Q3 to conduct more heavily, thus raising the voltage across R3 and consequently diminishing V_{BE} in Q2. In turn, Q2 produces a lower drive current to Q1, thus lowering the output current back to its desired value.

If voltage control is desired and you happen to have an LM317 IC on hand, the circuit of Figure 7 easily provides this capability and lowers the current as a battery begins to achieve its desired charge level. The LM317 is a voltage regulator that will limit its output to a set value so that the battery will never be allowed to charge above that value. When the battery is at a low charge voltage, the difference between it and the LM317 set value will be high so that the charging current will be as high as the solar panel can provide. As the battery charges, the difference will decrease and the charging current will reduce until the battery reaches the LM317 set value and the charging current is then near zero as charging is terminated. From then on, the battery floats at the set voltage. During the high current part of the charging, the LM317 is dissipating the power produced by the voltage across it times the current through it and could be a

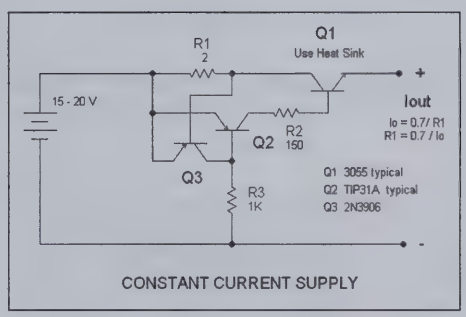


Figure 6—Current controller using discrete components.

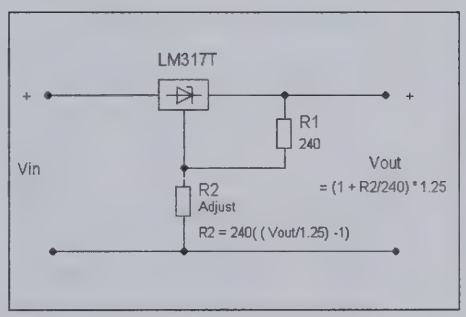


Figure 7—A simple solar panel controller.

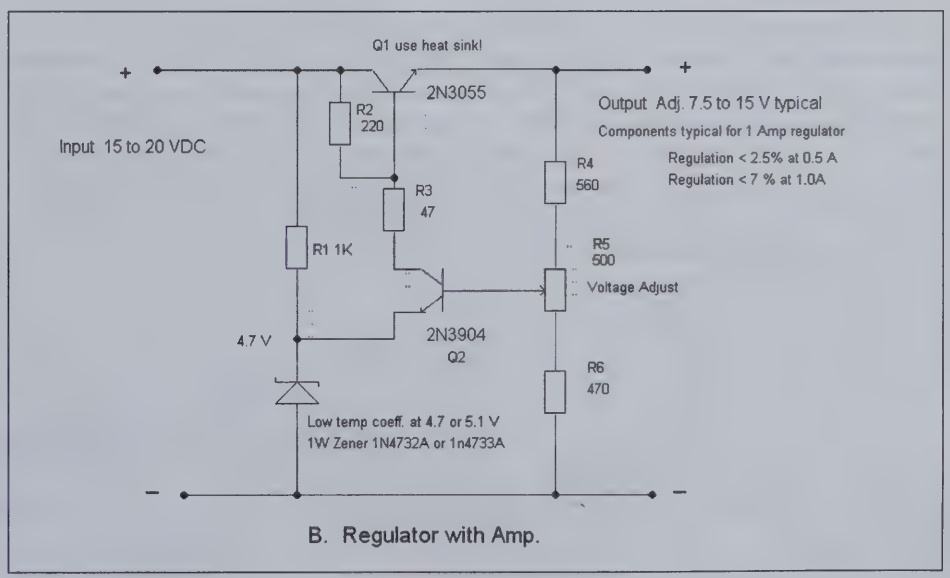


Figure 8—Adjustable voltage controller.

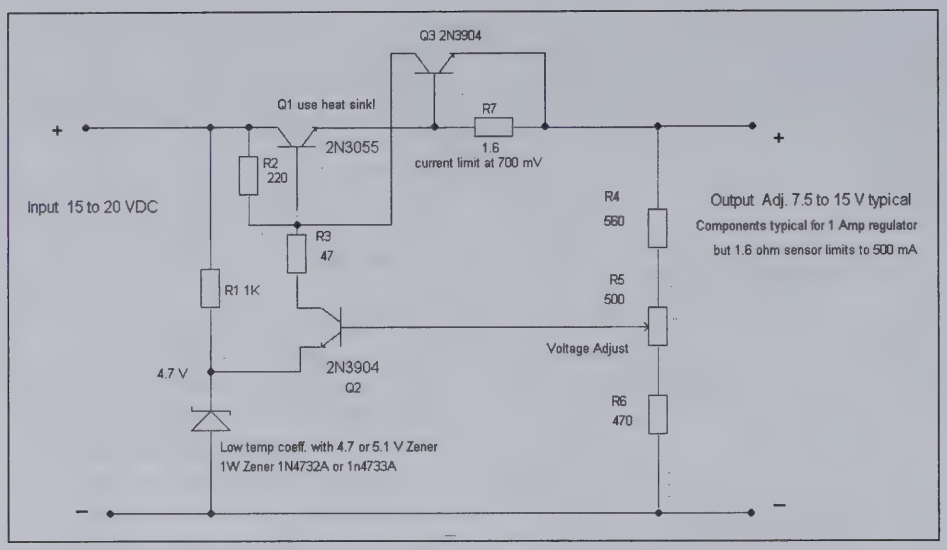


Figure 9—Voltage controller with maximum current limit.

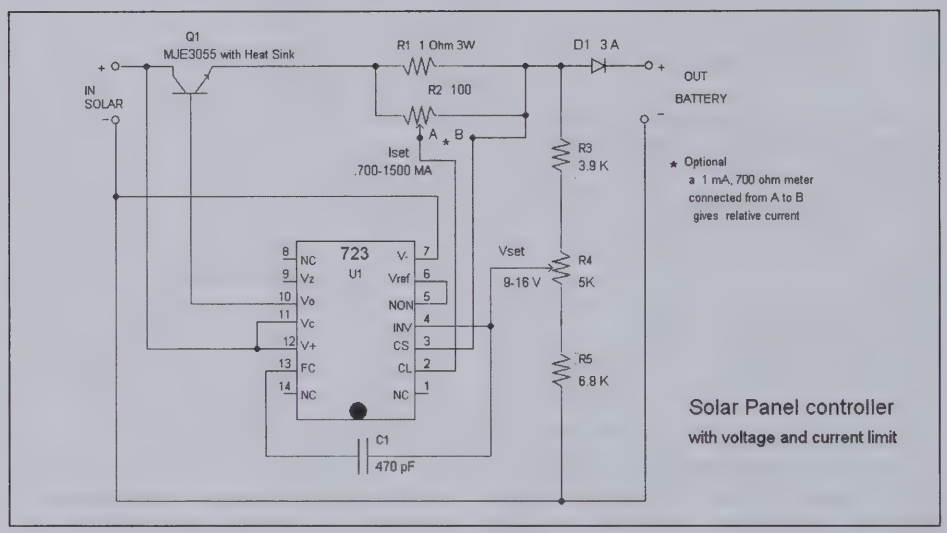


Figure 10—A highly flexible solar controller.

fair amount, thus the necessity for a heat sink on the LM317. The dissipation is low during the low current float.

If you don't happen to have an LM317 handy, Figure 8 supplies a different approach to voltage control. Here a zener diode provides a voltage reference to which a portion of the output voltage is compared by Q2. If the output voltage gets too high, Q2 pulls current from the base of Q1 so that it reduces the output voltage. Again as in the LM317 circuit, when the battery charge is low and Q1 is passing a lot of current, Q1 dissipates power per its voltage drop times pass current and needs a heat sink to keep it cool enough to perform properly.

Figure 9 adds some protection to the circuit of Figure 8 by providing a maximum current limit through Q1. The circuit of Figure 9 would be appropriate in cases where current must be limited to a maximum value. For example, that value might be the maximum charging current for a particular battery. Voltage level is set at the full charge value for the battery, or perhaps a very small amount higher if a light trickle charge is required once the battery is fully charged. Be careful here as too high a trickle charge current holds the possibility of damaging the battery. Operation of the Figure 9 circuit is much like the circuit of Figure 8 in so far as voltage regulation is concerned. The current limiting feature is supplied by R7 and Q3. As the current limit is approached, the voltage across R7 is enough to turn Q3 on and pull base current from Q1 to hold the output current to the limit.

If you expect to use your solar controller with several combinations of solar panels and/or batteries, or if you plan to increase the capability of your solar power system over time, then the circuit of Figure 10 is for you. The heart of the circuit is the LM723, a special purpose IC intended to supply both voltage and current regulation at levels chosen by two variable resistors.

Limits on input voltage and current variability are set only by Q1, the pass transistor, and its heat sink. I have built several controllers for my solar panels that use the LM723 because of its ability to cover a wide range of battery types and requirements. Note that the current sensing shunt in the controller can also provide voltage for a current indicator/meter. But remember, if you don't require all the flexibility of Figure 10, any of the above circuits are useful.

Good luck with your new solar power system. Go outside and have some fun with it! ●●

QRP = Doing More With Less

Antennas 101: Elevated Verticals

Gary Breed—K9AY k9ay@k9ay.com

Most hams install vertical antennas at ground level, but it is not unusual to mount them on a fencepost or rooftop. This short note shows how height affects the performance of verticals, which behave differently than horizontal antennas like dipoles. (I've discussed this installation option in past columns, but it's useful to have a review from time-to-time.)

Figure 1 shows a series of radiation patterns for a 40-meter vertical, starting with (a) ground mounted with a good radial system. Next, (b), (c) and (d) show the antenna with four horizontal radials, installed at 4 feet, 15 feet and 40 feet. These heights correspond to installation on a fencepost, rooftop, and either a tall rooftop or short tower.

As height increases, the pattern changes to a lower takeoff angle, which improves DX performance. However, at 40 feet, there is a large high-angle lobe that negates most of the benefit from the low angle lobe. I didn't include gain because my version of EZNEC+ uses NEC-2, which does not accurately model gain close to ground. Of the four heights shown, gain will be maximum at the 15-foot height.

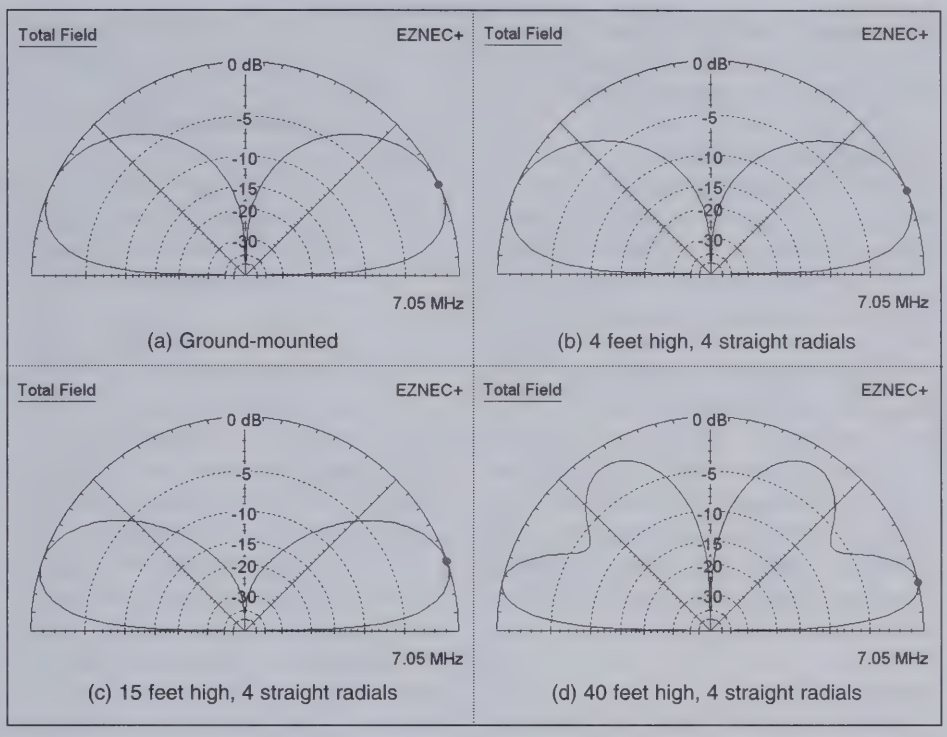


Figure 1—Radiation patterns for a 40 meter 1/4-wave vertical at four different installation heights.

Figure 2 shows the pattern for the vertical mounted at 15 feet, but with the radials sloped downward to 4 feet at the ends, in the common "ground plane" style. The sloped radial configuration raises the feedpoint impedance from 36 ohms to 50 ohms. The pattern shape is between that of straight radials at 4 and 15 feet, as we would expect since the average height of the sloped radials is 9.5 feet.

Sloping the radials also accomplishes a bonus in performance—better operation on 15 meters, the 3rd harmonic of 40 meters. Figure 3 compares the patterns on 15 meters with straight radials, and with sloped radials. You can see that the sloped radials have a bit more gain and less high-angle radiation. Also, when pruned for the best compromise between 40M and 15M, the VSWR is less than 1.5:1.

In the past I have had some elevated verticals that worked very well. A rooftop 15M ground plane strapped to a chimney at about 25 feet height was an excellent antenna, easily working plenty of DX at QRP power (2 to 5 watts). Also, I have used the 40M/15M sloped-radial version with just two radials as an extra antenna for ARRL Sweepstakes or North American QSO Party contests. Hung from a tree with the feedpoint at 15 feet, it provided many QRP and 100W QSOs.

So don't be afraid to install a vertical—including commercial "no radial" multiband verticals—at heights above ground level. They will work just fine, maybe even better than at a lower height or ground mounted. ●●

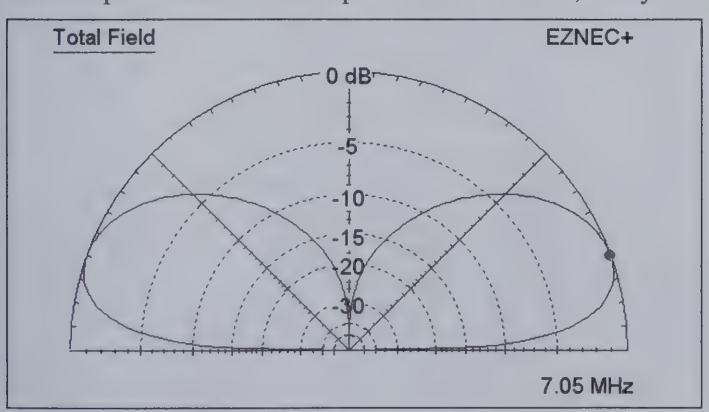


Figure 2—40M radiation plot with downward sloped radials.

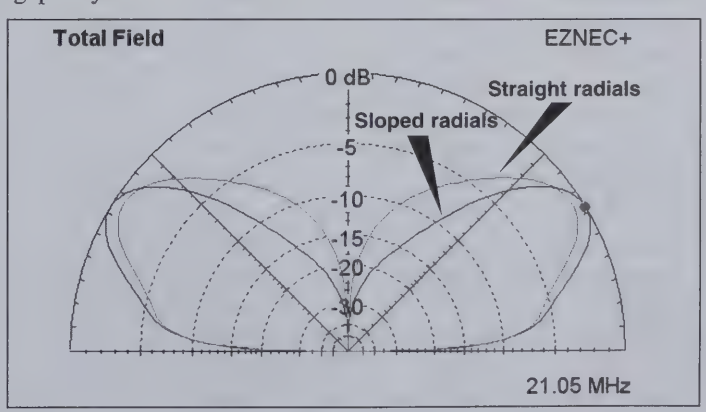


Figure 3—15M radiation pattern comparison.

QRP Contests

Jim Rodenkirch—K9JWV contest@qrparci.org

The three contests I can report on this quarter are the HF Grid Square, Spring QSO Party and the Hoot Owl Sprint.

Mark Your Calendars!

Welcome to QRP — 25 August 2012 — 1500Z to 1800Z

The Two Side Bands Sprint — 8 & 9 September 2012
USB (10m, 15m, 20m): 1500–2100Z on 8 September; 1500–2100Z on 9 September
LSB (40m, 80m): 2100Z on 8 September to 0300Z on 9 September,
and 2100Z on 9 September to 0300Z on 10 September

Fall QSO Party — 13–14 October 2012
1200Z on 13 October 2012 through 2400Z on 14 October 2012

HF Grid Square Contest

The number of participants, sixteen, for the HF Grid Square contest was down from the average. Tim Colbert, K3HX, submitted the top score for all categories, earning 9744 points for Single Op, Single Band, 40 meters (SOSB-40)! Brian Campbell, VE3MGY, continues his mastery of the Single Op, Low Bands (SOLB) category with a final score of 8505. Comments from K3HX, K9FO and VA3RKM regarding the high level(s) of QRN verify what I experienced while operating during this event—conditions were not the best. I'm posting the results spreadsheet for you to peruse.

Spring QSO Party

The Spring QSO Party was a different matter—participation exceeded the average and some HUGE scoring showed up.

The Multi-Op team, AA5B, KK6MC, K5TQ and W9YA, showed up to play, garnering a final score of 1,506,064! Bob Patten, N4BP, captured the Single Op, All Band (SOAB) certificate with an impressive score of 632,709. Equally noteworthy was the score for Team T&J—K5FSE and K4TJD turned in a combined score of 134,820 which is noticeable because the difference in scores between the two operators was <5% so they were truly operating as a team, submitting complimentary results. We had a nice turnout of participants from the Canadian and EU contingents. Eight of our Canadian brethren submitted logs, along with entries from EA, OH and SP land; I thoroughly enjoyed processing those "DX" log entries and hope to see more of those logs in future events. The bulk of comments centered on the fact that the contest spanned Easter weekend with much participating evident on Saturday and little on Easter Sunday. We'll look at ensuring that the 2013 offering isn't over Easter weekend! The bulk of comments focused on enjoying this contest equally with the Fall QSO Party; those types of notes were found in the comments of our recent survey. I'm including the results spreadsheet for you to peruse.

Hoot Owl Sprint

The last contest for reporting during this quarter is the Hoot Owl Sprint. Brian Campbell, once again, dominated the Single Op, Low Band (SOLB) category and, in fact, had the high score for all categories while Jim Rinehart, K9PX, and Jim Colbert, K3HX, turned in fine scores for their respective categories. There were only 16 logs submitted and, one suspects, the advent of summer has a lot to do with participation being low. The QRN levels, once again, were an impediment. This from Brian, VE3MGY, "Never heard

2012 HF GRID SQUARE CONTEST RESULTS

NAME	CALL	SPC	ENTRY CLASS	QSOs: Members	QSOs: Non-Members Diff. Continent	QSOs: Non-Members Same Continent	SPC TOTAL	POWER MULT	FINAL SCORE
Tim Colbert	K3HX	PA	SB 40	15	0	6	16	7	9744
Brian Campbell	VE3MGY	ON	LB	15	0	3	15	7	8505
Jim Wilson	VE3MO	ON	SB 40	8	0	1	8	10	8360
Scott Covert	KG3W	PA	AB	16	0	2	14	7	8232
Mertin Nellis	WØUFO	MN	AB	13	0	1	12	7	5628
Barry Ives	AJ2T	NY	AB	11	0	3	13	7	5551
Curt Milton	WB8YYY	MD	AB	12	0	2	12	7	5376
Garry Nichols	WA1GWH	NY	SB 40	10	0	0	7	7	2450
Randy Foltz	K7TQ	ID	SB 20	7	0	0	7	7	1715
Scott McMullen	W5ESE	TX	AB	5	0	2	7	7	1421
Paul Gerhardt	K3PG	MD	SB 40	7	0	1	5	7	1295
Robert MacKenzie	VA3RKM	ON	AB	5	0	1	6	7	1134
Will Bowser	K9FO	IL	AB	5	0	0	5	7	875
Larry Mergen	KØLWV	MO	SB 20	5	0	0	5	7	875
Pete Quinn	N1PQ	MA	SB 40	4	0	1	4	7	616
Tony Ploski	W2HWW	NJ	SB 20	1	0	0	1	10	50

2012 QRP ARCI SPRING QSO PARTY RESULTS

NAME	CALL	SPC	ENTRY CLASS	QSOs: Members	QSOs: Non-Members Diff. Continent	QSOs: Non-Members Same Continent	SPC TOTAL	POWER MULT	FINAL SCORE
AA5B, KK6MC, K5TQ, W9YA	AA5B	NM	Multi-op AB	240	8	175	136	7	1506064
John McBee, Lester Grandon	KM5PS	AR	Multi-op AB	61	0	15	42	7	98490
Houston QRP Club, W5ACM, N5EM	W5MSQ	TX	Multi-op AB	13	0	1	13	7	6097
Bob Patten	N4BP	FL	SOAB	183	7	73	83	7	632709
Jim Lageson (NØUR)	WAØMN	MN	SOAB	142	1	63	81	7	476280
Dean Faklis	NW2K	NY	SOAB	130	2	33	87	7	440916
John Laney	K4BAI	GA	SOAB	128	3	45	76	7	394744
Mike Michael	W3TS	PA	SOAB	86	2	21	67	10	321600
Paul Beckett	KF7MD	CO	SOAB	93	0	28	62	7	226114
Andrew Measday	WA5RML	TX	SOAB	88	0	27	61	7	210938
Dale Putnam	WC7S	WY	SOAB	85	1	38	58	7	205030
Jon Thompson	K3MD	PA	SOAB	90	1	32	52	7	188552
Dave Hotell	AB9CA	AL	SOAB	75	0	32	54	7	165942
Bob MacKenzie	VA3RKM	ON	SOAB	56	0	27	51	7	119238
Hank Greeb	N8XX	MI	SOAB	66	0	20	43	7	111370
Art Petteway	WB4MNK	FL	SOAB	60	1	12	45	7	103320
Joe Vrabel	KD2JC	NJ	SOAB	57	1	10	41	7	88683
Ed Dybowski	WD7Y	NV	SOAB	51	0	17	42	7	84966
Ray Cornelison	KJ4AOM	KY	SOAB	43	0	23	38	7	69426
John Collins	KN1H	NH	SOAB	41	0	7	40	7	61320
Jim Wilson	K5ND	TX	SOAB	31	0	8	39	7	46683
Scott McMullen	W5ESE	TX	SOAB	31	1	16	33	7	44121
Don Younger	W2JEK	NJ	SOAB	34	0	10	33	7	43890
Dennis Terribile	WR4I	VA	SOAB	30	0	7	23	10	37720
William Schmidt	WV1N	CT	SOAB	26	0	9	35	7	36260
Merton Nellis	WØUFO	MN	SOAB	15	1	16	41	7	31857
Terru Bachman	W9UX	WI	SOAB	32	0	11	25	7	31850
Mike Sexton	NT7R	MT	SOAB	30	0	4	27	7	29862
Al Dawkins	KØFRP	CO	SOAB	26	0	9	25	7	25900
Randy Drake	KB4QQJ	NC	SOAB	24	0	8	27	7	25704
Scott Walker	N3SE	PA	SOAB	25	0	12	24	7	25032
Dave New	N8SBE	MI	SOAB	31	0	7	21	7	24843
Mike Baker	K7DD	AZ	SOAB	27	0	4	24	7	24024
Arthur Jackson	KA5DWI	TX	SOAB	29	0	4	22	7	23562
Tom Lappin	WØUY	KS	SOAB	30	0	7	20	7	22960
Larry Mergen	KØLWV	MO	SOAB	23	0	7	25	7	22575
Riley Dudley	K4ORD	VA	SOAB	23	0	6	25	7	22225
Joe Spencer	KK5NA	TX	SOAB	33	0	4	18	7	21798
Scott Covert	KG3W	PA	SOAB	25	0	6	22	7	21098
Dave Reid	VE6BIR	AB	SOAB	21	0	7	24	7	19992
Bob Woisch	WB3T	PA	SOAB	24	0	6	21	7	19404
Joseph Mead	K2JT	NJ	SOAB	20	0	7	24	7	19152
Larry Card	W9CC	IN	SOAB	21	0	5	20	7	16100
Brian Murrey	KB9BVN	IN	SOAB	17	0	9	21	7	15141
Scott Zastoupil	KBØ0KFX	WI	SOAB	19	0	6	20	7	14980
Ron Silvia	WB1HGA	MA	SOAB	23	0	3	16	7	13552
Al Britton	KIØJ	CO	SOAB	21	0	1	18	7	13482
Bert Cook	K6CSL	CA	SOAB	17	1	6	19	7	13433

Results continued on next page

2012 QRP ARCI SPRING QSO PARTY RESULTS *(continued)*

NAME	CALL	SPC	ENTRY CLASS	QSOs: Members	QSOs: Non-Members Diff. Continent	QSOs: Non-Members Same Continent	SPC TOTAL	POWER MULT	FINAL SCORE
Peter Inskeep	NO2D	CO	SOAB	21	0	2	15	7	11445
Bill Unger	VE3XT	ON	SOAB	15	0	3	17	7	9639
Don Mcbride	K3RLL	PA	SOAB	16	0	3	16	7	9632
John Schreiner	N2LK	NJ	SOAB	15	0	4	16	7	9296
Clark Macaulay	WU4B	GA	SOAB	16	0	4	15	7	9240
Tony Ploski	W2HWW	NJ	SOAB	11	0	3	14	10	8540
Jim Cluett	W1PID	NH	SOAB	15	0	4	14	7	8134
Tim Prosser	KT8K	MI	SOAB	13	0	3	15	7	7455
Larry Makoski	W2LJ	NJ	SOAB	16	0	2	12	7	7056
Curt Hulett	KB5JO	TX	SOAB	9	0	8	11	10	6710
Brock Thomsen	W6GMT	MN	SOAB	14	0	1	12	7	6048
Rene Laplante	VE2KOT	ON	SOAB	12	0	3	13	7	6006
Lou Visconti11	KD2MU		SOAB	11	1	2	13	7	5733
A. Robert Pantazes	W2ARP	NJ	SOAB	9	0	2	10	7	3430
Michael Babineau	VA2NB	QC	SOAB	8	0	2	9	7	2772
Alan Schaefer	AC8AP	OH	SOAB	4	0	3	7	7	1274
Drew Arnett	KB9FKO	CA	SOAB	1	0	2	2	7	126
Chuck Morehead	AAØLV	KS	SOAB	0	0	2	2	7	56
Charles Moizeau	W2SH	NJ	SOAB	36	0	10	22	7	30800
James Diggs	K4AHO	FL	SOAB	36	0	4	23	7	30268
Eric Castro	VA3MAX	ON	SOAB	30	0	4	24	7	26544
Steve Hutcherson	WB5CTS/M	OK	SOAB	22	0	10	21	7	19110
Jim Stoneback	K4AXF	VA	SOAB	20	0	4	17	7	12852
Jorge Raul Accunzi	EA2LU	EA	SOHB	52	12	1	35	7	75950
Jim Stafford (W4QO)	K6JSS	GA	SOHB	23	0	2	16	10	19040
Paul Goemans	WA9PWP	WI	SOHB	19	0	5	17	7	12495
Greg Lane	N4KGL	AL	SOHB	14	0	13	18	7	12096
Ken Norman	VE7KBN	BC	SOHB	13	0	2	12	7	5796
Nick Nichols	WB5BKL	TX	SOHB	14	0	1	10	7	5040
Don Minkoff	NK6A	CA	SOHB	10	0	3	9	7	3528
Jack Welch	AI4SV	VA	SOHB	5	1	2	7	7	1617
Chuck Strou	KA8HDE	MN	SOHB	4	0	1	5	7	770
Paul Kirley	W8TM	OH	SOLB	100	0	41	61	7	248514
Richard Borroughs	N5KIP	LA	SOSB: 15	5	0	0	4	7	700
Phillip Gratier	W3HZZ	GA	SOSB: 20	14	0	1	12	7	6048
Risto Tiilikainen	OH2BT	OH	SOSB: 20	4	0	0	4	10	800
Tom Wawer	SQ5RIX	SP	SOSB: 20	1			1	1	5
Brian Campbell	VE3MGY	ON	SOSB: 40	83	2	48	41	10	212790
Jim Rinehart	K9PX	IN	SOSB: 40	103	0	68	41	7	186837
Les Shattuck	K4NK	SC	SOSB: 40	29	0	8	16	7	18032
Jim Rodenkirch	K9JWV	UT	SOSB: 80	7	0	2	8	10	3120
Jack Nelson	K5FSE	GA	Team T&J	43	0	8	30	10	69300
Tom Dooley	K4TJD	GA	Team T&J	46	2	11	36	7	65520
Jim Bandy	K5JFB	TX	SOAB	5	0	1	6	7	1134

ARCI members on 40M or 80M and both bands were noisy. Ran 1 Watt on 80M but was running 5 Watts on 40M so had to enter the A1 category." One interesting comment came from Kent Helfrich, N8DIV, who writes, "K2 @ 900 mW into G5RV up 30 feet. My first QRP contest and I appreciate the patience of the other operators. Lots of fun—made me brush up a bit on my rusty CW skills. Next contest, I will try to be portable." How cool is that??? First contest, got to polish up his CW skill and plans on being portable next time around. Great to see that from a "first timer to our QRP world!" I'm including the results spreadsheet for your perusal.

The next contests coming up in the next couple months include:

The Welcome to QRP contest on 25 August 2012

The Two Side Bands Sprint—USB (10m, 15m, 20m) and LSB (40m, 80m)—on 8 & 9 September 2012

Fall QSO Party: 13 & 14 October 2012

Check the contest rules that are posted at www.qrparci.org

2012 HOOT OWL SPRINT RESULTS

NAME	CALL	SPC	ENTRY CLASS A/B	ENTRY CLASS Band	QSOs: Members	QSOs: Non-Members Diff. Continent	QSOs: Non-Members Same Continent	SPC TOTAL	POWER MULT	FINAL SCORE
Brian Campbell	VE3MGY	ON	A1/B2	SOLB	0	46	14	42	7	43512
Jim Rinehart	K9PX	IN	A1/B2	SOSB-40	26	11	0	19	7	20216
Tim Colbert	K3HX	PA	A1/B1	SOAB	20	6	0	18	7	14112
Greg Lathrop	KA4GUM	GA	A1/B2	SOSB-40	2	0	0	2	7	5140
Richard Beerman	W5AK	TX	A1/B2	SOSB-40	9	7	0	12	7	4956
Garry Nichols	WA1GWH	NY	A1/B2	SOSB-40	10	3	0	10	7	3920
Don Younger	W2JEK	NJ	A1/B1	SOAB	7	2	0	9	7	2457
Tom Beard	WA4ZOF	AL	A1/B2	SOSB-40	5	0	0	5	7	875
Kent Helfrich	N8DIV	MI	A2/B2	SOSB-40	3	0	0	3	10	450
Ted Albert	AB98FJ	OH	A1/B2	SOSB-40	3	0	0	3	7	315
Bill Kirby	VO1BB	NL	A1/B2	SOSB-20	1	3	0	4	7	308
Phil Bowers	KBØETU	AL	A1/B2	SOSB-40	2	1	0	2	7	168
John Wilcox	W3HI	WVA	A1/B2	SOSB-40	2	0	0	2	7	140
Ron Silvia	WB1HGA	MA	A1/B2	SOSB-20	1	1	0	2	7	98
Ted Stanton	KK4CPO	GA	A1/B2	SOLB	1	0	0	1	7	35
Steve Lybarger	NU7T	NV	A1/B2	SOSB-40	0	1	0	1	7	14

A Final Note:

I'm writing this article on Sunday, 17 June. The CW portion of the QRP Shootout is over and, from all indications, there was little participation for that half of the event. If low levels of participation during these summer months continue we might want to look at suspending some of the events, reducing the length(s) or shorten them up and move them to a week day. If you believe they should continue and have a suggestion for "improving participation," write me an e-mail and tell me your thoughts. Finally, implantation of at least one of the suggested changes off that recently completed survey—the addition of the A1/A2 and B1/B2 categories—has taken place. Steve, G4GXL, our webmaster is adapting those changes into the rest of this year's contest rule listings as time permits. Looking forward to hearing and working you on the bands and, or in, the upcoming contests.

—72, Jim Rodenkirch, K9JWV

Upcoming QRP-ARCI Contests

Welcome to QRP
25 August 2012
1500Z to 1800Z

The Two Side Bands Sprint
USB (10m, 15m, 20m) and LSB (40m, 80m)
8 & 9 September 2012
USB: 1500Z to 2100Z on 8 September, and 1500Z to 2100Z on 9 September
LSB: 2100Z on 8 September to 0300Z on 9 September, and 2100Z on 9 September to 0300Z on 10 September

Fall QSO Party
13 & 14 October 2012
1200Z on 13 October 2012 through 2400Z on 14 October 2012.

Top Band Sprint
29 November 2012
0000Z to 0600Z
Note: this is the evening of 28 November 2012 in North America

Holiday Spirits Homebrew Sprint
16 December 2012
2000Z to 2359Z

See **www.qrparci.org** for rules and additional information

QRP ARCI STAFF

President
Ken Evans—W4DU
848 Valbrook Ct.
Lilburn, GA 30047
w4du@bellsouth.net

Vice President
Steve Fletcher—G4GXL
43 Philip Rudd Court, Pott Row
Kings Lynn, Norfolk PE32 1WA, UK
vp@qrparci.org

Treasurer, Membership/Subscriptions
Jack Nelson—K5FSE
1540 Stonehaven
Cumming, GA 30040
secretary@qrparci.org

Awards Manager
Paul Stroud—AA4XX
1318 Alderman Cir.
Raleigh, NC 27603
awards@qrparci.org

Contest Manager
Jim Rodenkirch—K9JWV
762 East St. James Lane
St. George, UT 84790
contest@qrparci.org

Webmaster
Steve Fletcher—G4GXL
43 Philip Rudd Court, Pott Row
Kings Lynn, Norfolk PE32 1WA, UK
webmaster@qrparci.org

BOARD OF DIRECTORS

Jay Bromley—W5JAY
3424Brooken Hill Dr.
Fort Smith, AR 72908
jayw5jay@cox.net

Steve Fletcher—G4GXL
43 Philip Rudd Court, Pott Row
Kings Lynn, Norfolk PE32 1WA, UK
webmaster@qrparci.org

Ed Hare—W1RFI
304 George Washington TPKE
Burlington, CT 06013
w1rfi@arrl.org

Jeff Hetherington—VA3JFF
139 Elizabeth Street West
Welland, ON L3C 4M3, CANADA
VE3JFF@yahoo.ca

Bill Kelsey—N8ET
3521 Spring Lake Dr.
Findlay, OH 45840
n8et@woh.rr.com

Brian Murrey—KB9BVN
47 Grassy Dr.
New Whiteland, IN 46184
editor@qrparci.org

ARCI[SM] and QRP ARCI[SM] are service marks of QRP Amateur Radio Club International

Your membership lasts forever—but your subscription to *QRP Quarterly* must be renewed!

Go to the QRP ARCI web site and use the Online Member Lookup feature to keep track of your membership/subscription status:

http://www.qrparci.org/lookup.html

QRP ARCI takes membership applications and renewals via credit card—*online*—using the **PayPal** system. *We prefer it for all applicants—worldwide*! Go to the club web site:

http://www.qrparci.org/us2signup.html

and follow the instructions. Be sure to select the appropriate button for the area of the world you reside in (US, Canada, or DX). International members may send payment by check directly to the club Treasurer, but ... ***funds must be drawn on a U.S. bank and be in U.S. dollars.*** Make checks payable to: **QRP ARCI**.

When renewing, please enclose the mailing label from your *QRP Quarterly*. Send applications by mail to:

QRP ARCI
Jack Nelson, K5FSE
1540 Stonehaven
Cumming, GA 30040

Subscribe or Renew Now!
Don't Miss an issue of QRP Quarterly

Sign me up for a ❑ **NEW** / ❑ **RENEWAL** membership in QRP ARCI!

❑ **1 YEAR** ($25 US — US$28 Canada and Elsewhere)

❑ **2 YEARS** ($50 US — US$56 Canada and Elsewhere)

These amounts include active club member privileges and your QRP Quarterly subscription

Call _____ QRP ARCI number (if renewal) _____

Full Name _____

Mailing Address _____

City _____ State/Country _____

Postal Code (ZIP+4 US) _____

Previous Callsign(s) if any _____

(The following information is optional; used only by QRP ARCI; not released to others)

E-mail address _____

Comments _____

_____

Send check or money order to: **QRP ARCI**
1540 Stonehaven
Cumming, GA 30040

QRP Quarterly (ISSN #1551-1537) is published quarterly in January ("Winter"), April ("Spring"), July ("Summer") and October ("Fall") by AY Technologies LLC, 3300 State Road 78, Mount Horeb, WI, 53572. Periodical postage paid at Mount Horeb, WI and at additional mailing offices.

POSTMASTER: Send address corrections to QRP Quarterly, P.O. Box 43, Mount Horeb, WI 53572-0043. Subscription information: (608) 437-1200.

Subscription prices (all in U.S. dollars): Domestic one year $25, two years $50; Canada and elsewhere one year $28, two years $56.

QRP Quarterly is the official publication of the QRP Amateur Radio Club International (QRP ARCI), which is responsible for all editorial content. Editorial submissions should be sent to the Editor or an Associate Editor. See the staff listing on page 3 of each issue. Membership/subscription inquiries should be sent by e-mail to: secretary@qrparci.org, or by mail to QRP ARCI,1540 Stonehaven, Cumming, GA 30040.

This magazine is published under agreement with QRP ARCI by AY Technologies LLC — Mailing address: P.O. Box 43, Mount Horeb, WI 53572-0043, tel: 608-437-1200.

Copyright © 2012 by AY Technologies LLC, All rights reserved.

Your New Trail Friendly Radio

See www.tentec.com for special springtime pricing

TEN-TEC's New R4000 Series

High-performance, dual-band, fully-assembled, 5-watt CW rigs

Features:

- The R4020 operates on 40/20 meters. The R4030 operates on 40/30 meters. Both receive 5-16 MHz (SSB/CW).
- Two-line easy-to-read LCD display. RIT mode 10 Hz and 100 Hz steps. Internal keyer and CQ memory keyer.
- Eight selectable bandwidths. Two internal battery packs.
- Works great on the road, on the trail, or in the shack. Just add a key or paddles and an antenna.
- Anyone can talk around the world with stacked beams and legal-limit power. DXCC on 5 watts? Sure! What's holding you back?

Here's what *QST* has to say...

"I was very favorably impressed with its operation"

"This radio is sophisticated and offers quite a few features… It is a long way from the simple QRP gear many of us enjoyed years ago"

"The QRP world is very exciting. The enthusiasm of the QRP group is remarkable."

"(The radio) should hold up well to physical abuse"

"(It) should prove to be a winner"

Read the entire review in the February 2011 issue of *QST*!

TEN-TEC QRP – It's the next radio for thousands of hams. Join them!

Order Now!

www.tentec.com/r4000/
(800) 833-7373

The Formula for FUN:

(Ten-Tec QRP) × (Low Power) × (Low Price) = FUN!

Find out more

www.tentec.com

BUY FACTORY DIRECT

TEN-TEC

1185 Dolly Parton Pkwy., Sevierville, TN 37862. Sales: (800) 833-7373, sales@tentec.com. Office: (865) 453-7172. FAX: (865) 428-4483. Service: (865) 428-0364, service@tentec.com M-F 8 AM-5 PM (Eastern Time). We accept Visa, MC, American Express and Discover. All TEN-TEC radios come with our 30-day money-back guarantee.

ELECRAFT KX3

The Revolutionary KX3 All-Band/All-Mode Transceiver

Our new KX3 is a competition-grade transceiver that literally puts the world in the palm of your hand. With its large display, rich control set, and adjustable operating angle, the ultra-compact KX3 is equally at home on your desktop, in a vehicle, or in remote field locations. It's a true software-defined radio (SDR), with dual watch, noise reduction, digital voice recorder, RX/TX EQ, VOX, split-band speech compression, and CW keyer. The built-in PSK31 and RTTY modes work with or without a computer. Add the internal ATU, battery pack, and roofing filters for unmatched portability *and* performance.

- 160-6 m (internal 2 m option planned)
- SSB/CW/AM/FM/DATA modes
- 10 W output (100 W with KXPA100 amp)
- World-class receive performance
- Built-in advanced 32-bit DSP
- Supports PC-based remote control and logging; SDR applications via RX I/Q outputs; simple firmware updates
- Factory-assembled or easy-to-build, no-soldering kit; manual written with first-time HF users in mind
- 1.7" x 3.5" x 7.4" (4.3 cm x 8.9 cm x 18.8 cm) 1.5 pounds (less options and 8-AA cell battery pack)
- Current drain as low as 150 mA; 9-15 V DC

ELECRAFT®

For complete features and specifications, go to www.elecraft.com